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THE SILVER-BURDETT ARITHMETICS

BOOK TWO

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THE SILVER-BURDETT ARITHMETICS

BOOK TWO

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SILVER–BURDETT ARITHMETICS

Two Book Series

BOOK ONE
COMPLETE BOOK

Three Book Series

BOOK ONE
BOOK TWO
BOOK THREE

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PREFACE

Book Two of the Silver-Burdett Arithmetics has been prepared for grades five and six.

Part One, intended for the fifth grade, emphasizes fundamental operations and Common Fractions; it gives an elementary treatment of Decimals through thousandths, and of Denominate Amounts.

Part Two, intended for the sixth grade, reviews fundamental operations, reviews and extends the work of the fifth grade in Common Fractions, treats as fully as conditions demand, the subjects of Decimals, Denominate Amounts, and Practical Measurements, and presents enough of the elementary facts of Percentage to give pupils who leave school at the close of the sixth year, a practical idea of Profit and Loss, Trade Discount, Commission, Interest, the Promissory Note, the Check, and the Receipt.

Attention is invited to the following features of the book:

1. *The abstract problems* for developing accuracy and speed; and the *well-graded, concrete problems*, free from puzzling conditions, for securing mental discipline and for bringing the child into closer touch with the affairs of modern life.

2. *The development, through simple diagrams, of the important principles of Fractions,* and the sight drills for fixing these principles.

3. *The prominence given to Decimals* to the end that pupils may become proficient in a subject so extensively used later, both in school and in business.

4. *The model solutions* of prominent types of problems, so arranged as to encourage pupils to present their work in neat form, thus assisting the teacher in her effort to correct the many inaccurate expressions in common use.

5. *The frequent and extended Reviews* which afford abundance of problem material for large classes.

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PART ONE

SECOND BOOK

WHOLE NUMBERS

NOTATION AND NUMERATION

Introductory Exercises

1. 1. Beginning at one, name the first nine numbers.

2. Name the ten figures used in writing numbers.

3. Ten *ones* make what?

4. Beginning at ten, name and write in order the nine tens.

5. How many figures are used to express a number made up of tens and units?

6. Write the number made up of 5 tens and 4 units.

7. Write the smallest number that can be written with two figures; the largest.

8. Ten *tens* make what?

9. Name and write in order the first nine hundreds.

10. How many figures are used to express a number made up of hundreds, tens and units?

11. Write the smallest number that can be written with three figures; the largest.

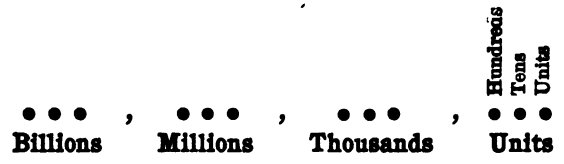
12. Ten *hundreds* make what?

2. When more than three figures are used to express a whole number, they are usually separated into groups or **periods** of three figures each so that the number may be more easily read.

Exercise 1

1. In the following table how many periods are shown?

Table



2. How many **places**, or **orders**, are there in each period?

3. Name the places in units' period.

4. Copy the table on the blackboard and write the names of the places of each period shown.

5. Counting from the right, in what place does 1 hundred stand? 1 thousand? 1 million? 1 billion?

6. How many 0's are used to write 1 thousand? 1 million? 1 billion?

7. Beginning at the right, name the periods to billions.

8. Counting from the right, name the second period; the fourth; the third; the first.

9. Counting from the right, name the third place; the fourth; the sixth; the fifth; the seventh; the second; the eighth.

10. In the number 456, name the place that the 4 occupies; the 5; the 6.

11. In the number 86,475,239, what does the 86 represent? the 475? the 239?

Exercise 2

Read aloud each of these exercises:

1. 64,389,157

Thus, *sixty-four million three hundred eighty-nine thousand one hundred fifty-seven.*

2. 5619	3. 6038	4. 31,187
5. 67,802	6. 51,783	7. 432,107
8. 567,149	9. 733,924	10. 6,984,125
11. 3,907,534	12. 98,546,837	13. 87,631,052
14. 76,353,489	15. 563,819,306	16. 8,965,738,462

17. The average income of physicians in a certain state is $3907 a year, and the average expenses $3190.

18. The salary of the President of the United States is $75,000; the salary of the Vice President is $12,000.

19. The salary of the Governor of Illinois is $12,000.

20. The police force in New York City numbers more than 10,000.

21. The greatest depth of the Pacific Ocean is 30,000 feet.

22. The total cost of the Brooklyn bridge has been more than $22,400,000; it is 7580 feet long.

23. The distance of the moon from the earth is 240,000 miles.

24. The distance of the sun from the earth is 93,000,000 miles.

25. The ten largest cities in the world are: LONDON, which had a population of 7,429,740 in 1909; NEW YORK, which had a population of 4,766,883 in 1910; PARIS, which had a population of 2,763,393 in 1906; TOKIO, which had a population of 2,186,079 in 1908; CHICAGO, which had a population of 2,185,283 in 1910; BERLIN, which had a population of 2,101,933 in 1908; VIENNA, which had a population of 2,085,888 in 1909; ST. PETERSBURG, which had a population of 1,678,000 in 1905; PHILADELPHIA, which had a population of 1,549,008 in 1910; and Moscow, which had a population of 1,359,254 in 1907.

Exercise 3

Copy the following, writing the numbers in figures:

1. The Post Office Department of the United States employs more than three hundred thousand persons who handle more than fifteen billion pieces of mail each year. They handle more than eight hundred thousand letters every hour of the twenty-four hours of each day.

2. The Dead Letter Office receives about twelve million "dead" letters and parcels a year and about eight million post cards. Ten million letters and parcels are opened, and of these about six million are forwarded to the persons to whom they are addressed or returned to the writers. More than eighty-five thousand photographs come to the dead letter office each year.

3. Washington is the most beautiful city in the United States. It has ten large parks, twenty-six others more than an acre each in size, and two hundred seventy-five little parks of less than an acre each. It has more than ninety-two thousand trees, while Paris, one of the most beautiful cities in the world, has but eighty-five thousand. Yet there are more than three million people living in Paris, and only about three hundred fifty thousand living in Washington.

4. In nineteen ten the population of Boston was six hundred seventy thousand five hundred eighty-five; of St. Louis, six hundred eighty-seven thousand twenty-nine; of Los Angeles, three hundred nineteen thousand one hundred ninety-eight; of Atlanta, one hundred fifty-four thousand eight hundred thirty-nine; of Minneapolis, three hundred one thousand four hundred eight; of Nashville, one hundred ten thousand three hundred sixty-four; of Baltimore, five hundred fifty-eight thousand four hundred eighty-five; of Columbus, one hundred eighty-one thousand five hundred forty-eight; of Pittsburg, five hundred thirty-three thousand nine hundred five.

Roman Notation

Exercise 4. Review

1. Name the seven letters used in writing numbers by the Roman system, and tell for what number each stands.

2. For what does II stand? III? XX? XXX? CC? CCC? MM? MMM?

3. For what does VI stand? VII? VIII? XI? XII? XIII? LI? LII? LIII?

4. For what does IV stand? IX? XL? XC? CD? CM?

Read these numbers:

5. XIV; XVI; XLIX; XLIV; LXIV; XC.

6. LXXXIX; XCVI; CIV; CXLIX; CLXXXI; CM.

7. CDXL; MCD; MCM; MCMXXI; MCMXIV; MCMXXIX.

Tell at sight the letter or letters that stand for each of the following:

8.	11;	50;	15;	60;	90;	100.
9.	105;	110;	150;	200;	400;	600.
10.	1000;	1100;	1500;	1600;	2000;	1900.
11.	1910;	1912;	1915;	1920;	1925;	3000.

Reading and Writing Dollars and Cents

Exercise 5. Review

1. Write the symbol that stands for dollar or dollars.

2. Write the abbreviation for cent or cents.

3. Write, using the dollar sign:

14 dollars; 23 dollars; 92 dollars; 100 dollars.

87 dollars; 120 dollars; 600 dollars; 984 dollars.

4. Write, using ¢ for cents:

2 cents; 11 cents; 20 cents; 53 cents.

22 cents; 47 cents; 65 cents; 90 cents.

5. If a sum of money consists of dollars and cents, where is the decimal point placed?

6. Read:

$7	$12	$18	$6.43	$7.02
$9.09	$10.27	$0.43	$0.72	$4.07

7. Write, using the dollar sign:

6 dollars; 4 dollars 20 cents; 1 dollar 8 cents.

40 cents; 6 dollars 11 cents; 14 cents.

To the Teacher. — Review addition, subtraction, multiplication, and division of United States money, as taught in grades below the fifth, in connection with the study of Addition, Subtraction, Multiplication, and Division as these subjects are reached in this book.

ADDITION

3. Addition is the process of uniting two or more numbers into one number, called their **sum.**

NOTE. — An **amount** is an expression denoting the number and kind of units in a quantity; as, 5 yards, 2 bushels, 6 dollars, 4 horses. **Similar amounts** are such as are composed of the same kind of units of quantity; as, 3 pounds and 2 pounds. Similar amounts, and only such, can be added. Some writers call amounts **concrete numbers.**

The sign of addition is +, read **plus.**

Exercise 6

3 6 9 4 8 7 5

Add at sight each of the numbers above the line to

1. 21	2. 34	3. 47
4. 62	5. 75	6. 25
7. 13	8. 36	9. 19

In the following look for groups and add the groups:

10.	11.	12.	13.	14.	15.
7	1	4	3	6	7
3	5	2	7	4	8
1 } 9	2	6	3	5	9
5	6	3	5	8	6
4	3	7	6	3	7
3 } 9	4	5	2	6	9
2	5	1	4	2	5
5	6	4	7	8	9
3 } 10	2	6	1	4	8
2	1	3	2	6	7

Thus, in Example 10 look for groups, as indicated, and say aloud: *10, 19, 28, 35.*

Add at sight:

16.	17.	18.	19.	20.	21.
9	6	12	2	11	10
8	11	6	18	3	18
11	15	13	4	9	11
7	9	17	8	16	10
10	13	7	12	10	7
12	1	3	4	5	8
2	5	6	1	3	2

Thus, in Example 16, observing that $2+12+10$ may be grouped as 24, say aloud: *24, 31, 42, 50, 59.*

Add at sight the following:

22. $54+37$ Thus, say aloud: *54, 84, 91.*

23. $12+20$	24. $37+40$	25. $58+30$
26. $21+17$	27. $35+16$	28. $44+23$
29. $48+34$	30. $55+36$	31. $55+38$
32. $72+41$	33. $73+55$	34. $85+64$
35. $75+67$	36. $86+48$	37. $85+59$
38. $86+78$	39. $85+67$	40. $98+89$
41. $79+86$	42. $83+78$	43. $89+86$
44. $76+69$	45. $92+78$	46. $79+99$
47. $81+94$	48. $69+77$	49. $59+88$

Exercise 7

(Accuracy and Speed Test. Practice until you can add all the exercises on this page in less than 10 minutes.)

1.	2.	3.	4.	5.
251847	6	438761	641072	125637
6538	78	54721	334078	946183
78	534	6310	840149	627854
54310	6429	278	648732	249836
5	96823	13	357986	135792
621	681024	7	177162	357546
426	65237	333	987634	143657
253749	6229	542713	354672	354276

6.	7.	8.	9.	10.
2078	6290	10785	112817	197643
1213	1816	7521	9154	6528
4398	4336	4695	2736	8045
338746	547236	163187	975313	468102
135709	129735	153846	197663	165482
253748	268943	216480	206489	310647
497481	421087	436459	465291	508467
22078	24362	34689	39720	47611
31107	36794	48936	46723	50897
8741	1638	2367	1489	7629
56778	767831	10892	26783	237469

11.	12.	13.	14.	15.
183645	256387	48756	12345	7536781
163789	267348	78439	12647	6372846
278564	263746	54236	14526	1362735
263845	163703	17373	10843	2738465
345271	263809	25748	10839	4527384
327846	352748	34253	26645	3647586
436485	462748	36489	35471	4094611
501625	352810	33947	63109	3284764
410987	346784	26738	63923	5981006
329706	352189	50723	69800	2073392

Problems

4. 1. A cattle dealer sold 2565 head of stock in January, 3856 head in February, 4357 head in March, 5210 head in April, and 6432 head in May; how many head did he sell in the five months?

2565 = the number of head he sold in January.
3856 = the number of head he sold in February.
4357 = the number of head he sold in March.
5210 = the number of head he sold in April.
6432 = the number of head he sold in May.
22420 = the number of head he sold in the five months.

2. A man bought a lot for $600, paid $65 to have it graded, $132 for paving, and $4250 to have a house built on it. What did his property cost him?

$ 600 = the cost of the lot.
$ 65 = the cost of the grading.
$ 132 = the cost of the paving.
$ 4250 = the cost of the house.
$ 5047 = the cost of the property.

Exercise 8

1. A man threshed his crop of grain; it consisted of 248 bu. of wheat, 678 bu. of oats, and 124 bu. of rye; how many bushels of grain were there in his crop?

2. Five loads of wheat weighed as follows: 3256 lb., 3478 lb., 3981 lb., 2108 lb., and 3456 lb.; how many pounds were there in the five loads?

3. A farmer's barn cost him as follows: for lumber $476; for masons' work $148; for hardware $62; for painting $85; and for grading $12; what did the barn cost him?

4. Copy and add:

A dealer bought in one week:

	675 chickens weighing	3275 lb.	for	$ 493
	375 turkeys weighing	3300 lb.	for	$ 495
	245 ducks weighing	980 lb.	for	$ 98
He bought	fowls weighing	lb.	for	$

SUBTRACTION

5. Subtraction is the process of finding by how many units one number exceeds another, or how many units are left by taking part of a number from it. The greater number is called the **minuend**, the smaller the **subtrahend**, and the result the **difference** or the **remainder**.

The sign of subtraction is $-$, read **minus**, and denotes when written between two numbers that the latter is to be subtracted from the former.

In the subtraction of amounts the minuend, the subtrahend, and the difference must be similar amounts.

Exercise 9

Starting with the number above the line, subtract at sight, in succession, the numbers below the line in the following examples:

1.	2.	3.	4.	5.	6.	7.	8.
57	76	83	91	86	115	123	164
2	9	4	7	8	6	5	9
9	2	5	4	5	7	4	5
6	9	9	6	7	4	8	6
5	3	7	5	9	9	6	7
8	5	6	2	2	8	9	3
3	4	1	8	3	3	1	2
4	7	2	3	1	2	7	8

Thus, in Example 1 say aloud: *57, 55, 46, 40, 35, 27, 24, 20.*

Give the results at sight:

9. $49 - 20$.

Thus, say instantly, *29*.

10. $78 - 32$.

Thus, think 78 minus 30 minus 2; say instantly, *46*.

11. $82 - 25$.

Thus, think 82 minus 20 minus 5; say instantly, *57*.

12. $65 - 20$	13. $86 - 30$	14. $58 - 16$
15. $96 - 42$	16. $78 - 25$	17. $97 - 56$
18. $41 - 28$	19. $52 - 48$	20. $60 - 18$
21. $54 - 36$	22. $85 - 47$	23. $91 - 26$

Exercise 10

(Accuracy and Speed Test. Practice until you can subtract all examples in this exercise in less than 10 minutes. Check by adding the difference to the subtrahend to make the minuend.)

1. 3754 2363	2. 8471 8374	3. 4732 3645	4. 5663 2349
5. 6320 5468	6. 6534 3985	7. 6905 2907	8. 8408 4686
9. 7074 5385	10. 7136 3367	11. 32964 13079	12. 42580 28374
13. 78013 59634	14. 93486 67099	15. 97523 78642	16. 60413 29865

17. 55463	18. 76054	19. 39064	20. 87531
17085	52706	19375	48719
21. 874312	22. 520016	23. 401435	24. 751946
486153	240167	398561	520975
25. 329648	26. 420653	27. 619862	28. 367452
168739	30968	59906	174863
29. 437109	30. 617542	31. 86146	32. 48007
248318	49635	9907	8099

Problems

6. 1. There were 380,546 people living in Maryland in 1810 and 1,295,346 in 1910; what was the increase for the hundred years?

1,295,346 = the population of Maryland in 1910.
380,546 = the population of Maryland in 1810.
914,800 = the increase in the 100 years.

2. The Mississippi River is 3160 miles long and the Arkansas 2170 miles long; what is their difference in length?

3160 mi. = the length of the Mississippi River.
2170 mi. = the length of the Arkansas River.
990 mi. = the difference in length.

Exercise 11

1. A man's earnings were $1250 a year; how much did he save if his expenses were $892?

2. A man's house and lot cost him $5256; the lot cost him $675; what did the house cost him?

3. The sum of three numbers is 10,000; two of them are 5760 and 2148; what is the third?

4. After a man has made two payments, one of $275 and the other of $168, on a debt of $500, how much does he still owe?

5. A man deposited, during a certain week, $2275. He drew out at one time $280, at another $340, and at another $1286; how much had he then in the bank?

6. Copy and find the missing remainders:

	Bu. of Wheat	Bu. of Oats	Bu. of Rye
A farmer's crop consisted of	873	621	430
He sold	424	321	220
There then remained			

MAKING CHANGE

In making change it is customary to add to the amount of the sales enough change to make the sum of the sales and the change equal the money given in payment.

Thus, a man bought a basket for 35 cents and gave the merchant a dollar bill; the merchant, using the least number of pieces of money possible, gave the customer a 5-cent piece, a dime, and a half-dollar, and as he did so said, "*thirty-five, forty, fifty, one dollar.*"

Exercise 12

Count aloud the change in each of the following, using in each case as few pieces of money as possible:

	Sales	Money Paid	Change
1.	\$0.16	\$ 0.25	?
2.	\$0.39	\$ 0.50	?
3.	\$0.34	\$ 0.50	?
4.	\$0.45	\$ 1.00	?
5.	\$0.32	\$ 1.00	?
6.	\$1.18	\$ 1.50	?
7.	\$1.21	\$ 2.00	?
8.	\$2.85	\$ 4.00	?
9.	\$2.10	\$ 5.00	?
10.	\$2.25	\$10.00	?

MULTIPLICATION

7. Multiplication is the process of taking one number or amount called the **multiplicand** additively as many times as there are units in another number called the **multiplier**. The result of multiplication is called the **product**.

8. The multiplier is always a *number*, and if the multiplicand is an amount, the product must be a similar amount.

9. The sign of multiplication is $\times$, read **times** when the multiplier is written before it, and **multiplied by** when the multiplier is written after it.

Thus, $3 \times \$4$ is read 3 *times* \$4.

$\$4 \times 3$ is read \$4 *multiplied by* 3.

10. Here we see that three rows of four dots each contain as many dots as four columns of three dots each; which shows that:

$$3 \times 4 = 4 \times 3.$$

Exercise 13

Read the following; name the multiplicand, the multiplier, and give at sight the product:

1. 7×6 pk.
2. 7 bu. $\times$ 8
3. 8×12 doz.
4. 9 sq. ft. $\times$ 8
5. 11×12 units
6. 10×7 da.
7. 6×9 ft.
8. 12 doz. $\times$ 12
9. $10 \times \$12$
10. 8×8 qt.

Special Multipliers

11. 1. Multiply 48 by 10.

10×8 units $= 80$ units, or 8 tens.
10×4 tens $= 40$ tens, or 4 hundreds.
The product is 4 hundreds + 8 tens, or 480.

Annexing one cipher to a number multiplies it by 10.

2. Multiply 48 by 100.

$$100 \times 48 = 10 \times 10 \times 48$$
$$= 10 \times 480$$
$$= 4800.$$

Annexing two ciphers to a number multiplies it by 100

3. Multiply 48 by 1000.

$$1000 \times 48 = 10 \times 100 \times 48$$
$$= 10 \times 4800$$
$$= 48000.$$

Annexing three ciphers to a number multiplies it by 1000.

4. Multiply 7 by 30.

$$30 \times 7 = 10 \times 3 \times 7$$
$$= 10 \times 21$$
$$= 210.$$

In practice, multiply 7 by 3 and annex a cipher.

5. Multiply \$3 by 32.

$$32 \times \$3 = 3 \times \$32.$$
$$= \$96.$$

Exercise 14

Name at sight the product:

1. 10×7	2. 10×8	3. 10×6
4. 10×25	5. 10×48	6. 10×52
7. 10×216	8. 10×346	9. 10×428
10. 10×90	11. 10×150	12. 10×360
13. 100×5	14. 100×7	15. 100×4
16. 100×35	17. 100×82	18. 100×26
19. 1000×4	20. 1000×5	21. 1000×8
22. 1000×7	23. 1000×2	24. 1000×6
25. 40×6	26. 50×8	27. 70×5
28. 60×9	29. 90×4	30. 80×7

31. 200×8	32. 300×6	33. 200×9
34. $24 \times \$2$	35. $48 \times \$2$	36. $32 \times \$4$
37. $46 \times \$3$	38. $27 \times \$3$	39. $21 \times \$4$

Multiplication of Any Number by a Number of Two Figures or More

12. Multiply 3582 by 346.

```
 3582
  346
-----
21492
14328
10746
-------
1239372
```

The multiplier is $300 + 40 + 6$.
$6 \times 3582 =$ what? (1st partial product)
$40 \times 3582 =$ what? (2d partial product)
$300 \times 3582 =$ what? (3d partial product)
What does the 8 of the 2d partial product express?
In the form, what figure is omitted from the 2d partial product?
What does the 6 of the 3d partial product express?
In the form, what figures are omitted from the 3d partial product?

Special Forms

(*A*)	(*B*)	(*C*)	(*D*)
\$75.25	3286	4586	7600
37	304	3009	270
526 75	13144	41274	532
2257 5	9858	13758	152
\$2784.25	998944	13799274	2052000

Exercise 15

1. 348×269	2. 287×430	3. 408×563
4. 456×607	5. 398×490	6. 563×489
7. 675×564	8. 578×731	9. 570×604

10. $513 \times \$21.34$	11. $465 \times \$30.25$	12. $324 \times \$42.50$
13. 639×599	14. 667×708	15. 723×405
16. 704×598	17. 780×509	18. 820×564
19. 865×697	20. 996×670	21. 878×703
22. 569×4508	23. 640×6892	24. 753×7084
25. 4306×2398	26. 3097×5680	27. 4670×6709
28. 5073×4987	29. 6708×4538	30. 5007×6832
31. 8135×6008	32. 7830×6509	33. 6998×7215
34. 8305×7125	35. 7080×8637	36. 9065×8603

Problems

13. 1. A printing press that prints 295 copies of a paper in a minute will print how many copies in 9 minutes?

295 = the number of copies printed in 1 minute.

9

2655 = the number of copies printed in 9 minutes.

2. Find the cost of 375 tons of coal at \$ 6 a ton.

SUGGESTION. — $375 \times \$6 = 6 \times \$375$.

Exercise 16

1. At \$175 an acre, what will a farm of 250 acres cost?

2. How much tuition is paid in a year by 900 students, if each pays \$250?

3. How many pounds are there in 35 bales of cotton, each weighing 500 lb.?

4. What is the cost of a shipment of 275 tons of coal at $5 a ton?

5. Light moves at the rate of 186,000 miles a second; how far will it move in 12 seconds?

6. A contractor built 24 houses and sold them for $3250 each; what did he receive for them?

7. If sound travels 1090 feet per second and you see the flash of a gun 6 seconds before you hear the sound, how far are you from the gun?

8. If one pipe discharges 40 gallons of water per hour, and another 86 gallons per hour; how much more will the second discharge than the first in 24 hours?

DIVISION

14. Division is the process of finding one of the equal parts of a number or amount; or how many times one number or amount is contained in another. The **dividend** is the number or amount divided. The **divisor** is the number or amount by which we divide. The **quotient** is the result of the division.

15. The sign of division is $\div$, read **divided by.**

Thus, $24 \div 4 = 6$, is read 24 *divided by* $4 = 6$.

16. If in the division there is an undivided part of the dividend less than the divisor, this undivided part is called the **remainder.**

Thus, $27 \div 4 = 6$, with a *remainder* of 3 undivided. If the division were completed, the quotient would be $6\frac{3}{4}$ with no *remainder.*

17. Finding one of the equal parts of a number or amount, which is division proper, is sometimes called **partitive division**, or **partition**. In this kind of division the divisor is always a number, and if the dividend is an amount, the quotient is a similar amount.

Thus, $\$60 \div 5 = \$12$.

18. Finding how many times one number or amount is contained in another is sometimes called **comparative division**, or **mensuration**, the process being one of *measuring* the dividend by the divisor used as a *unit of measure*. In this kind of division the quotient is always a number, and if the dividend is an amount, the divisor must be a similar amount.

Thus, 20 yd. $\div$ 2 yd. $= 10$. *In practice*, divide 20 by 2.

It is evident from Sections 17 and 18 that such expressions as "20 sq. yd. $\div$ 4 yd. $= 5$ yd."; also, "30 cu. ft. $\div$ 10 sq. ft. $= 3$ ft." cannot be justified, and should not be employed.

Exercise 17

Name at sight the quotient and the remainder:

1. $49 \div 6$	2. $57 \div 7$	3. $60 \div 9$
4. $58 \div 7$	5. $52 \div 8$	6. $70 \div 8$
7. $83 \div 9$	8. $67 \div 8$	9. $54 \div 7$
10. $74 \div 8$	11. $59 \div 9$	12. $73 \div 8$
13. $82 \div 9$	14. $75 \div 8$	15. $68 \div 7$
16. $86 \div 9$	17. $77 \div 8$	18. $89 \div 9$
19. $71 \div 9$	20. $85 \div 9$	21. $78 \div 8$

Special Divisors

19. 1. Since $10 \times 46 = 460$, $460 \div 10 = 46$, or $46\emptyset$.

Cutting one cipher from the right of a number divides the number by 10.

2. Since $100 \times 46 = 4600$, $4600 \div 100 = 46$, or $46\emptyset\emptyset$.

Cutting two ciphers from the right of a number divides the number by 100.

3. Since $1000 \times 46 = 46000$, $46000 \div 1000 = 46$, or $46\emptyset\emptyset\emptyset$.

Cutting three ciphers from the right of a number divides the number by 1000.

4. Since $30 \times 7 = 210$, $210 \div 30 = 7$; or $21\emptyset \div 3\emptyset = 7$.

In practice, cut off the same number of ciphers from the right of both dividend and divisor before dividing.

Exercise 18

Name at sight the quotient:

1. $230 \div 10$	2. $350 \div 10$	3. $280 \div 10$
4. $390 \div 10$	5. $560 \div 10$	6. $470 \div 10$
7. $420 \div 10$	8. $670 \div 10$	9. $580 \div 10$
10. $300 \div 100$	11. $600 \div 100$	12. $900 \div 100$
13. $2400 \div 100$	14. $3500 \div 100$	15. $4300 \div 100$
16. $6700 \div 100$	17. $5800 \div 100$	18. $8900 \div 100$
19. $4000 \div 1000$	20. $7000 \div 1000$	21. $8000 \div 1000$
22. $36{,}000 \div 4000$	23. $42{,}000 \div 600$	24. $76{,}000 \div 4000$

Long Division

20. 1. Divide 89,429 by 324.

	276 **Quotient**	8 ten thousands ÷ 324 = how many ten thousands?
Divisor 324	89429 **Dividend**	89 thousands ÷ 324 = how many thousands?
	648	894 hundreds ÷ 324 = how many hundreds?
	2462	324 × 2 hundreds = what?
	2268	894 hundreds − 648 hundreds = what?
	1949	
	1944	
	5 **Remainder**	

246 hundreds + 2 tens = how many tens?
2462 tens ÷ 324 = how many tens?
324 × 7 tens = what?
2462 tens − 2268 tens = what?
194 tens + 9 units = how many units?
1949 units ÷ 324 = how many units?
324 × 6 units = how many units?
1949 units − 1944 units = what?

Check: 324 × 276 + 5 = 89429.

2. Divide 654282 by 326.

2007	654 thousands ÷ 326 = what?
326)654282	654 thousands − 652 thousands = what?
652	2 thousands + 2 hundreds = how many hundreds?
2282	22 hundreds ÷ 326 = how many hundreds?
2282	

22 hundreds + 8 tens = how many tens?
228 tens ÷ 326 = how many tens?
228 tens + 2 units = how many units?
2282 units ÷ 326 = how many units?

Check: 326 × 2007 = 654282.

Special Form

Divide 627 by 200.

This shows the complete work:

$$200)\underline{627} = 200)\underline{600 + 27}$$
$$3 + \tfrac{27}{200}$$

In practice write only this:

$$2\not{0}\not{0})\underline{6 \mid 27}$$
$$3\tfrac{27}{200}$$

Exercise 19

Divide:

1. 2176 by 32	2. 4462 by 46	3. 4984 by 56
4. 5378 by 89	5. 1005 by 67	6. 7569 by 87
7. 7560 by 35	8. 17,325 by 25	9. 16,555 by 43
10. 33,761 by 49	11. 65,142 by 77	12. 34,970 by 26
13. 142,196 by 38	14. 383,614 by 47	15. 182,790 by 45
16. 13,212 by 48	17. 20,145 by 56	18. 37,604 by 63
19. 48,325 by 95	20. 40,106 by 87	21. 41,001 by 97
22. 142,272 by 416	23. 111,616 by 218	24. 211,932 by 609
25. 39,552 by 309	26. 477,006 by 642	27. 586,704 by 816
28. 480,198 by 489	29. 34,968 by 215	30. 236,418 by 300

Problems

21. 1. If 45 beams of equal weight weigh 16,200 lb. how much does each beam weigh?

$$\begin{array}{r} 360 \text{ lb.} = \text{the weight of each.} \\ 45)16200 \text{ lb.} = \text{the total weight.} \\ 135 \\ \hline 270 \\ 270 \\ \hline 0 \end{array}$$

2. A miller shipped 9800 lb. of flour in barrels; how many barrels did he ship if a barrel contains 196 lb.?

9800 lb. = the quantity of flour shipped.
196 lb. = the weight of each barrel.
50 = the number of barrels

$$\begin{array}{r} 50 \\ 196\overline{)9800} \\ 980 \\ \hline 0 \end{array}$$

Exercise 20

1. 84 town lots are valued at $44,184. If the lots are of equal value, what is the value of each?

2. If 12 acres of land produce 288 bu. of wheat, how much is that to the acre?

3. A farmer sold his farm, consisting of 85 acres, for $5100; how much was that an acre?

4. A teamster hauled 1190 rails in 14 loads; how many was that to the load?

5. Wheat weighs 60 lb. to the bushel. A farmer's wheat crop weighed 10,600 lb. How many bushels had he and how many pounds over?

6. A clerk who saves $25 a month will require how many months to save enough to pay for a $4000 house?

7. A mail carrier, whose route covers 24 miles per day, covers 12,000 miles in how many days?

8. What is the average weight of three steers whose weights are: 675 lb., 832 lb., and 902 lb.?

REMARK. — The average of two or more numbers is found by dividing their sum by the number of numbers added.

Thus, the average of 8, 12, and 16 is the sum of 8, 12, and 16, or 36, divided by 3, or 12.

9. What is the average age of three men, whose ages are 60 yr., 75 yr., and 81 yr.?

10. What is the average age of four children if two of them are each 9 yr. old, one of them 8 yr. old, and the other 6 yr. old?

11. Three loads of corn weigh 3846 lb., 3978 lb., and 4011 lb.; what is the average weight?

12. A man invested $11,220 in land at $85 an acre. How many acres did he buy?

13. The distance around a certain wheel is 3 feet; how many times will it turn in going 5280 ft.?

14. A drover bought young mules at an average of $85 a head and sold them at $100 a head; if he gained $900, how many mules did he sell?

REVIEW

Exercise 21

1. Read:

The Erie Canal was completed in 1826, it is 387 mi. long, is 7 ft. deep and has 72 locks. It cost $53,540,800.

2. Write one number to consist of 32 units of the millions' period, and 25 of the thousands' period.

3. Write the largest number possible that contains all of the letters I, V, X, C, each used but once in writing the number; write the smallest possible.

4. Write the largest number possible that contains all of the letters L, C, D, M, each used but once in writing the number; write the smallest possible.

5. Fill in the totals in the following sales of grain made by a farmer in one year:

Selling price of 176 bu. of wheat	@ $1.10 =	?
Selling price of 516 bu. of oats	@ .50 =	?
Selling price of 78 bu. of rye	@ .76 =	?
Selling price of 28 bu. of buckwheat	@ .85 =	?
Selling price of ? bu. of grain	=	?

6. If a man whose income is $175 a month spends $780 during the year, how much does he save that year?

7. What will it cost to construct a highway for a distance of 5480 ft. at $1.50 per foot?

8. How many days are there in 4 common years (365 da.) and 1 leap year (366 da.)?

9. Find the amount due a woman who sold and bought as follows:

Sold		Bought	
28 doz. eggs	@ 30¢	12 yd. of gingham	@ 18¢
18 lb. butter	@ 32¢	2 table covers	@ $2.50
25 lb. poultry	@ 14¢	12 yd. of toweling	@ 5¢
42 lb. lard	@ 7¢	20 yd. of muslin	@ 14¢

10. Two men commenced business with $500 each. During the year one gained $275 and the other lost $56. How much more had the one then than the other?

11. It requires 7260 plants for an acre of ground when they are set in rows three feet apart and set two feet apart in the rows; how many plants would it take for three acres, set in this way?

12. A man bought a farm for $7850. He spent $175 for improvements on it; he then sold it for $9000. What was his profit?

13. If the minuend is 2756 and the difference 596, what is the subtrahend?

14. If the subtrahend is 7450 and the difference is 1896, what is the minuend?

15. How many poor families can be supplied with 48 barrels of flour, each barrel weighing 196 lb., if 24 lb. are given to each family?

16. 5 tons of coal, of 2000 lb. each, were distributed among some poor families, each being given 200 lb.; how many families received part of the coal?

17. If a girl can paste 100 samples an hour, how much will she earn in 6 hours if she is paid 3¢ for each card of samples pasted, 24 samples to the card?

18. A bought a drove of cattle for $8170 and sold them for $10,750. There were 100 cattle in the drove. What was the average gain per head?

19. The sum of the ages of 47 citizens of a certain town is 3572 years. What is their average age?

20. Which is nearer a million dollars, and by how much, $1,100,000 or $900,009?

21. A merchant who spent $225 bought 65 lb. of butter at 30¢ per pound, 84 barrels of apples at $2.25 per barrel, and spent the remainder for coffee; how much did he spend for coffee?

22. During August 450,000 bushels of wheat were shipped from a certain port. During September 87,960 more bushels were shipped than during August. What was the total number of bushels shipped during the two months?

23. $1,000,000 is how many times $100,000?

24. A laborer who saves $20 a month must labor how many years to pay for 60 acres of land at $40 an acre?

25. If the dividend is 1728 and the divisor 144, what is the quotient?

26. A bushel of loose lime weighs 70 lb.; how many bushels may a man load who wishes to haul 2800 lb.?

27. Powder weighs 25 lb. per keg; how many pounds are there in a shipment of 2500 kegs?

28. A gardener sold in one season 675 bunches of onions at an average price of 9¢ a bunch; how much did he receive for all?

29. A bushel of dried apples weighs 26 lb.; what is the weight of 75 bu.?

30. The average wages paid to men working on farms in Pennsylvania in a recent year were $17.60 per month with board, or $27.18 without board; what is the estimated value of the board per year?

31. The average wages paid to farm laborers in Maine, in a recent year, were $23.17 with board; in Wisconsin, $24.39; what was the difference in the yearly wages of two laborers, one working in each state?

32. How many minutes are there in 24 hours?

ARITHMETICAL EXPRESSIONS

22. An **arithmetical expression,** or simply an **expression,** is any number or combination of numbers expressed in arithmetical symbols.

Thus, 5, $3+2+4$, $6-2+1$, 2×3, and $2\times 6\div 3$ are expressions.

23. The parts of an expression connected by $+$ or $-$ are called the **terms** of the expression.

Thus, in the expression $4\times 2+7-6\div 3$ there are three terms; the first term is 4×2, the second 7, and the third $6\div 3$.

24. Before the terms of an expression are combined, the operations of multiplication and division indicated in any term must be performed; and if two or more such operations are indicated in the same term, they must be performed in the order of their occurrence from left to right.

Thus, $3\times 6\div 2+10\div 5\times 2-18\div 3\div 2$ has three terms: the first $3\times 6\div 2=18\div 2$, or 9, the second $10\div 5\times 2=2\times 2$, or 4, the third $18\div 3\div 2=6\div 2$, or 3. The expression $=9+4-3$, or 10.

25. The **value** of an expression is the result obtained by performing the operations indicated.

Thus, the value of $12 \div 4 \times 3$ is 9.

26. The **parentheses** ( ) indicate that the value of the expression inclosed by them is to be found and used instead of the expression as a whole.

Thus, $5 \times (7 - 3)$ denotes that the difference of 7 and 3, or 4, is to be multiplied by 5.

27. Instead of the parentheses the brackets [ ], the braces { }, or the vinculum $\overline{\quad}$, may be used.

Exercise 22

Find the value of:

1. $4+3+5-1-3\times 2$.
2. $6\times 2+5+4-2\times 3$.
3. $9\div 3+6\times 2+3$.
4. $24\div 8\times 3-6\div 2$.
5. $35\div 7\times 5+5\times 2$.
6. $32\div 4+4\times 6\div 2$.
7. $\overline{3+2}\times 5+\overline{6-3}\times 2$.
8. $\overline{6-4}\times\overline{3+2}\div\overline{5\times 2}$.
9. $(12+4)\div(4\times 2)\times(5+1)$.
10. $(20-15)\times(10-10\div 5)\times(6-6\div 2)$.
11. $(100+44)\div 12+(20+44)\div 8+(25+5)\div 5$.
12. $6\times(9+3)-(120-20)\div 10+6\times 2\times(3+2)$.
13. $(320-160)\div 8-(324-248)\div 4+5\times(720-640)$.
14. $12\times(350-280)\div 6-(540-480)\div 15$
$+(412-216)\times(24-18)$.
15. $(36+48)\times(48-36)-(120-84)\div(18-6)$
$+(140-70)\div(70-35)$.

FACTORS AND DIVISORS

28. The **factors** of a number are such numbers as multiplied together will produce the number.

Thus, the factors of 15 are 3 and 5.

29. A number that has no other factor than itself and 1 is a **prime number**; as, $5 = 5 \times 1$.

30. A number composed of other factors than itself and 1 is a **composite number**; as, $15 = 5 \times 3$.

31. The same factor may be used more than once in forming a composite number. Each time it is so used it is considered a separate factor.

Thus, $36 = 2 \times 2 \times 3 \times 3$; here the factors of 36 are shown to be 2, 2, 3, and 3.

32. When all the factors of a number are prime numbers they are called the **prime factors** of the number.

Thus, in $12 = 2 \times 2 \times 3$, the prime factors of 12 are 2, 2, and 3.

Exercise 23

Name two factors that will produce

1. 6; 10; 15; 18.
2. 8; 9; 16; 25.
3. 14; 24; 21; 36.
4. 28; 52; 49; 50.
5. 56; 48; 63; 72.
6. 81; 54; 90; 110.

Name three factors that will produce

7. 12; 8; 27; 20.
8. 30; 28; 50; 42.

Tell which of the following numbers are prime:

9. 1; 2; 5; 8; 11; 14; 21.

10. 3; 6; 9; 12; 15; 18; 23.

11. 4; 7; 10; 13; 16; 20; 25.

12. Write all the prime numbers that are less than 20.

13. Write all the composite numbers that are less than 30.

Find the prime factors of:

14. 18 Thus, $18 = 2 \times 3 \times 3$.

15. 10	16. 12	17. 15	18. 20
19. 25	20. 30	21. 16	22. 36
23. 48	24. 50	25. 54	26. 60
27. 45	28. 40	29. 24	30. 32

33. A number that will divide a given number without a remainder is an **exact divisor**, or simply a **divisor**, of the given number.

Thus, 5 is a divisor of 10, but not of 11.

34. A divisor of each of two or more numbers is called a **common divisor** of them.

Thus, 5 is a common divisor of 10 and 20.

35. The greatest number that will divide each of two or more numbers is called their **greatest common divisor (g. c. d.)**.

Thus, 5 is the greatest common divisor of 10, 15, and 20.

Exercise 24

Name at sight two divisors of:

1. 6; 12; 15.
2. 14; 10; 21.
3. 35; 40; 48.
4. 54; 32; 45.
5. 65; 63; 72.
6. 90; 110; 132.

Name at sight three divisors of:

7. 20; 18; 50.
8. 30; 42; 28.
9. 45; 66; 44.
10. 36; 60; 48.

Name at sight the greatest common divisor of:

11. 20 and 30.
12. 24 and 36.
13. 30 and 45.
14. 36 and 48.
15. 21 and 28.
16. 36 and 45.

MULTIPLES

36. A number that a given number will exactly divide is called a **multiple** of the given number.

Thus, 6 is a multiple of 2, since 2 will exactly divide 6.

37. A number that each of two or more numbers will exactly divide is called a **common multiple** of them.

Thus, 12 is a common multiple of 2 and 3, since 2 and 3 will each exactly divide 12.

38. The least number that each of two or more numbers will exactly divide is called their **least common multiple** (l. c. m.).

Thus, 6 is the least common multiple of 2 and 3, since 6 is the least number that 2 and 3 will exactly divide.

Exercise 25

1. Name a multiple of 2; of 3; of 5; of 7.
2. Name three multiples of 2.
3. Name three multiples of 3.
4. Name two multiples of 7.
5. Name a common multiple of 3 and 4.
6. Name two common multiples of 2 and 3.
7. Name two common multiples of 4 and 5.
8. Name two common multiples of 2, 3, and 4.
9. Name a common multiple of 3, 4, and 6.

Name the least common multiple of:

10. 2 and 5. 11. 6 and 9. 12. 6 and 8.
13. 2, 3, and 4. 14. 2, 4, and 6. 15. 5, 10, and 15.
16. 4, 6, and 8. 17. 3, 6, and 9. 18. 2, 3, 4, and 6.

CANCELLATION

39. $(8 \times 3) \div (4 \times 3)$ may be written $\frac{8 \times 3}{4 \times 3}$.

$$\frac{8 \times 3}{4 \times 3} = \frac{24}{12} = 2 = \frac{8 \times \cancel{3}}{4 \times \cancel{3}}.$$

Crossing out, *canceling*, the same factor from both dividend and divisor does not change the quotient.

40. Find the value of $\frac{6 \times 9 \times 25}{10 \times 3}$, read *6 times 9 times 25, divided by 10 times 3.*

Thus, $\frac{\overset{2}{\cancel{6}} \times 9 \times \overset{5}{\cancel{25}}}{\underset{5}{\cancel{10}} \times \cancel{3}} = 45$

We cancel the 3 in the divisor, and the 3 from the 6 in the dividend, writing the quotient 2. We next cancel the 2 in the dividend and the 2 from the 10 in the divisor, writing the quotient 5. Then we cancel 5 from the divisor and 5 from the 25 in the dividend, writing the quotient 5. There then remain the factors 9 and 5 in the dividend; their product, 45, is the value of the expression.

Exercise 26

Write in the form shown in Section 40, and find the answer by cancellation:

1. 4×12 divided by 6.
2. 3×6 divided by 9.
3. 5×16 divided by 20.
4. 12×21 divided by 28.
5. 18×20 divided by 36.
6. 18×12 divided by 9×6.
7. 24×28 divided by 16×14.
8. 15×49 divided by 35×21.
9. $3 \times 5 \times 8$ divided by 30.
10. $6 \times 9 \times 12$ divided by 36.
11. $7 \times 2 \times 12$ divided by 28.
12. $5 \times 9 \times 14$ divided by 15×7.

Find by cancellation the quotient:

13. $\frac{16 \times 10 \times 6}{24 \times 20}$

14. $\frac{3 \times 14 \times 18}{21 \times 9}$

15. $\frac{15 \times 6 \times 12}{27 \times 10}$

16. $\frac{4 \times 27 \times 28}{12 \times 7 \times 18}$

17. $\frac{6 \times 8 \times 24}{12 \times 16 \times 3}$

18. $\frac{5 \times 8 \times 18}{2 \times 15 \times 12}$

19. $\frac{7 \times 26 \times 18}{21 \times 39 \times 2}$

20. $\frac{9 \times 8 \times 12 \times 15}{3 \times 16 \times 10}$

21. $\frac{7 \times 35 \times 16 \times 8}{28 \times 5 \times 14}$

22. $\frac{9 \times 27 \times 24 \times 40}{36 \times 18 \times 15}$

23. $\frac{8 \times 14 \times 20 \times 9}{16 \times 35 \times 12}$

24. $\frac{5 \times 26 \times 18 \times 4}{39 \times 15 \times 8}$

25. A farmer exchanged 18 pounds of butter, at 20 cents a pound, for cloth at 12 cents a yard; how many yards did he obtain?

26. A quantity of corn consisting of 273 bushels, each bushel weighing 56 pounds, was hauled in 6 loads; what was the average weight of the loads?

27. How many years would it require a laborer who saves 15 dollars a month for 12 months in a year to pay for 54 acres of land at 50 dollars an acre?

28. The yield of wheat from a 10-acre field is estimated at 30 bushels per acre; if a bushel of wheat weighs 60 pounds, how many tons of 2000 pounds each are there in the yield?

REVIEW

Exercise 27

Read:

1. In 1910 there were in the United States 177 cities each with a population between 25,000 and 100,000.

2. In 1910 there were 51 cities in the United States each with a population of over 100,000.

3. In 1910 the population of the earth was estimated at 1,522,700,000.

4. The following table shows the number of pupils enrolled in four counties of Pennsylvania for the year ending July 1, 1910. Fill in the totals.

County	Males	Females	Total
Chester . . .	9,801	9,776	
Bucks	6,969	6,759	
Delaware . . .	8,164	8,564	
Montgomery . .	13,885	13,342	
Total			

5. The population of the United States was 3,893,635 in 1790, and 93,402,151 in 1910. Find the increase in population during the 120 years.

6. A field of wheat that yielded 25 bu. to the acre produced 700 bu.; how much would have been produced had the yield been 30 bu. to the acre?

7. The product of two numbers is 625; one of them is 125; what is the other?

8. The divisor is 25, the quotient is 16, and the remainder is 12; what is the dividend?

9. How many yards of cloth at 12¢ a yard can be bought for 18 lb. of poultry at 16¢ per pound (cancel)?

10. How many years would it require a teacher, saving $30 a month for 10 months each year, to save enough to buy a $3600 property?

11. A miller shipped 12 loads of flour of 46 barrels each; what weight of flour was that, each barrel weighing 196 pounds?

12. After selling 8 loads of wheat, each containing 75 bushels, a farmer had 56 bushels left. How much wheat had he at first?

13. The sum of 2 numbers is 14,250. One of them is 5018. What is the other?

14. Write all the sets of factors of 24. How many of these sets are prime factors?

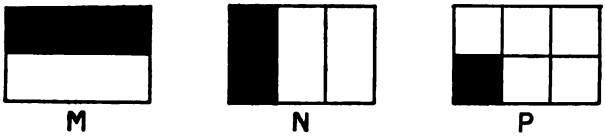
15. Find all the common divisors of 24 and 36.

16. A farmer had 118 bushels of wheat left after selling 226 bushels and sowing 24 bushels. How much had he at first?

17. Twelve times what number will make 1728?

FRACTIONS

INTRODUCTORY EXERCISES AND DEFINITIONS



1. What part of M is black? what part of N? what part of P? What part of M is white? what part of N? what part of P?

2. How many halves are there in one? how many thirds? how many sixths?

3. How many sixths are there in one half? in one third? in two halves? in two thirds? in three thirds?

4. How many sixths of a rectangle are there in N and one sixth of P together?

41. Any one thing is called a **unit.**

42. Any one of the equal parts of a unit is called a **fractional unit.**

Thus, one half and one third are fractional units.

43. Any number of equal fractional units is a **fraction.**

Thus, one half, two halves, two thirds, and seven sixths are fractions.

44. The number of equal parts into which a unit is divided to form fractional units is the **denominator,** and

the number of equal fractional units taken to make a fraction is the **numerator** of the fraction.

Thus, in the fraction two thirds, three is the denominator and two is the numerator.

45. The numerator and the denominator are together called the **terms** of the fraction.

46. A fraction is usually written in figures by writing the denominator below, and the numerator above, a line.

Thus, two thirds is written $\frac{2}{3}$.

47. A fraction which has both terms expressed is a **common fraction.**

Thus, $\frac{6}{4}$, $\frac{1}{4}$, $\frac{7}{4}$, are common fractions, but .5 is not a common fraction.

48. A fraction whose numerator is less than its denominator is called a **proper fraction.**

Thus, $\frac{1}{8}$ and $\frac{3}{4}$ are proper fractions.

49. A fraction whose numerator is equal to, or greater than, its denominator is called an **improper fraction.**

Thus, $\frac{4}{4}$ and $\frac{5}{4}$ are improper fractions.

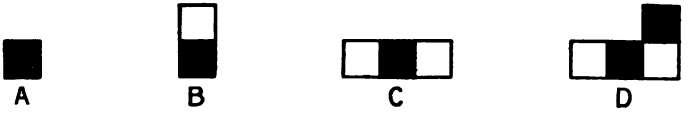
50. A number made up of a whole number and a fraction combined is called a **mixed number.**

Thus, $2\frac{1}{2}$, which means $2 + \frac{1}{2}$, is a mixed number.

NOTE. — A whole number is sometimes called an **integer.**

READING AND WRITING FRACTIONS AND MIXED NUMBERS

Exercise 28



1. How many squares are there in A? in B? in C? in D?
2. If 1 stands for D, what stands for C? for A? for B?
3. If 1 stands for C, what stands for D? for A? for B?
4. If 1 stands for B, what stands for A? for D? for C?

Exercise 29

Read each of the following and tell what it expresses:

1. $\frac{3}{4}$

Thus, $\frac{3}{4}$ is read *three fourths;* it expresses three fractional units, each of which is one fourth.

2. $\frac{5}{4}$ of a gallon

Thus, $\frac{5}{4}$ of a gallon is read *five fourths of a gallon;* it expresses five fractional units, each of which is one fourth of a gallon.

3. $2\frac{3}{4}$ bushels.

Thus, $2\frac{3}{4}$ bushels is read *two and three fourths bushels;* it expresses 2 bushels plus $\frac{3}{4}$ of a bushel.

4. $\frac{4}{5}$	5. $\frac{7}{8}$	6. $\frac{2}{3}$ of a yard
7. $\frac{5}{4}$	8. $\$2\frac{1}{2}$	9. $\frac{9}{8}$ of a peck
10. $\frac{3}{5}$	11. $\frac{10}{3}$	12. $\frac{5}{2}$ of a dollar
13. $7\frac{1}{2}$	14. $\$3\frac{3}{4}$	15. $6\frac{3}{4}$ pounds
16. $8\frac{1}{3}$	17. $\$12\frac{1}{2}$	18. $33\frac{1}{3}$ feet

Read aloud each of the following and tell whether it is equal to one, less than one, or greater than one:

19. $\frac{6}{7}$	20. $\frac{4}{2}$	21. $1\frac{1}{4}$
22. $\frac{3}{2}$	23. $\frac{5}{6}$	24. $\frac{8}{7}$
25. $2\frac{1}{3}$	26. $\frac{4}{3}$	27. $\frac{9}{10}$
28. $\frac{24}{25}$	29. $\frac{25}{24}$	30. $\frac{3}{3}$

31. In Examples 19–30 read the proper fractions; the improper fractions; the mixed numbers.

Exercise 30

Write in figures:

1. One half
2. Two thirds
3. Four fourths
4. Two and one half
5. Three and one third
6. Ten and two thirds
7. Five fourths
8. Three halves
9. Two sevenths of a week
10. Three and three fourths pecks
11. Three fourths of a mile
12. Two and one half square yards
13. Three twenty-fourths
14. Five eighths of an inch

Write in words:

15. $2\frac{1}{5}$	16. $\frac{4}{3}$	17. $\frac{1}{2}$
18. $1\frac{1}{7}$	19. $\frac{1}{6}$	20. $1\frac{7}{8}$
21. $\frac{1}{9}$	22. $\frac{1}{4}$	23. $\frac{6}{5}$

24. Write three proper fractions each with the denominator 4, and arrange them according to size, the least first.

25. If two unequal fractions have equal denominators, which has the greater numerator?

26. Write three improper fractions each with the numerator 4, and arrange them according to size, the least first.

27. If 2 unequal fractions have equal numerators, which has the greater denominator?

28. Name 4 fractions that are each equal to $\frac{2}{2}$.

REDUCTION

51. Changing the form of an expression without changing its value is called **reduction.**

52. A fraction is said to be reduced to **higher terms** when its numerator and denominator are made larger numbers.

Thus, $\frac{1}{2}$ is said to be reduced to higher terms when it is changed to $\frac{2}{4}$.

53. A fraction is said to be reduced to **lower terms** when its numerator and denominator are made smaller numbers.

Thus, $\frac{2}{4}$ is said to be reduced to lower terms when it is changed to $\frac{1}{2}$.

Reducing Fractions to Higher Terms; to Lower Terms

Exercise 31

From this drawing supply at sight the missing numerators in the exercises following:

1. $1=\frac{}{2}$	2. $\frac{2}{2}=\frac{}{4}$	3. $1=\frac{}{8}$	4. $\frac{3}{4}=\frac{}{8}$
5. $\frac{1}{2}=\frac{}{4}$	6. $\frac{3}{2}=\frac{}{4}$	7. $1\frac{1}{2}=\frac{}{8}$	8. $\frac{2}{8}=\frac{}{4}$
9. $\frac{1}{2}=\frac{}{8}$	10. $\frac{2}{2}=\frac{}{8}$	11. $\frac{1}{4}=\frac{}{8}$	12. $\frac{8}{8}=\frac{}{2}$
13. $2=\frac{}{2}$	14. $2=\frac{}{4}$	15. $2=\frac{}{8}$	16. $\frac{4}{8}=\frac{}{2}$
17. $\frac{4}{4}=\frac{}{2}$	18. $\frac{4}{4}=\frac{}{8}$	19. $\frac{6}{8}=\frac{}{4}$	20. $\frac{8}{8}=\frac{}{4}$

54. From the drawing in Exercise 31 we see that

$$\frac{3}{4}=\frac{6}{8}=\frac{2\times 3}{2\times 4}.$$

Also, $$\frac{6}{8}=\frac{3}{4}=\frac{6\div 2}{8\div 2}.$$

Multiplying or dividing both terms of a fraction by the same number does not change its value.

Exercise 32

Reduce at sight:

1. $\frac{2}{3}$ to twenty-fourths.

SUGGESTION. — Multiply both terms of $\frac{2}{3}$ by 8; that is, $24\div 3$.

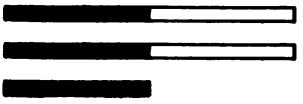
2. $\frac{18}{24}$ to fourths.

SUGGESTION. — Divide both terms of $\frac{18}{24}$ by 6; that is $24\div 4$.

3. $\frac{2}{3}=\frac{\ }{6}$	4. $\frac{3}{6}=\frac{\ }{2}$	5. $\frac{6}{8}=\frac{\ }{4}$	6. $\frac{3}{4}=\frac{\ }{12}$
7. $\frac{3}{4}=\frac{\ }{20}$	8. $\frac{9}{12}=\frac{\ }{4}$	9. $\frac{2}{3}=\frac{\ }{15}$	10. $\frac{10}{12}=\frac{\ }{6}$
11. $\frac{12}{15}=\frac{\ }{5}$	12. $\frac{5}{6}=\frac{\ }{18}$	13. $\frac{16}{24}=\frac{\ }{3}$	14. $\frac{15}{25}=\frac{\ }{5}$
15. $\frac{3}{4}=\frac{\ }{24}$	16. $\frac{21}{24}=\frac{\ }{8}$	17. $\frac{7}{8}=\frac{\ }{24}$	18. $\frac{20}{30}=\frac{\ }{3}$
19. $\frac{24}{32}=\frac{\ }{4}$	20. $\frac{5}{8}=\frac{\ }{40}$	21. $\frac{3}{8}=\frac{\ }{32}$	22. $\frac{9}{10}=\frac{\ }{50}$
23. $\frac{4}{5}=\frac{\ }{20}$	24. $\frac{7}{10}=\frac{\ }{100}$	25. $\frac{12}{16}=\frac{\ }{4}$	26. $\frac{60}{50}=\frac{\ }{5}$

Reducing Integers and Mixed Numbers to Improper Fractions

55. Reduce $2\frac{1}{2}$ to halves.



In one there are two halves, and in two there are two times two halves, or four halves; and in two and one half there are four halves plus one half, or five halves.

Exercise 33

Show by drawings that the following are true, and explain:

1. $3=\frac{6}{2}$	2. $3=\frac{9}{3}$	3. $2\frac{1}{3}=\frac{7}{3}$	4. $1\frac{2}{3}=\frac{5}{3}$
5. $2\frac{2}{5}=\frac{12}{5}$	6. $3\frac{1}{2}=\frac{7}{2}$	7. $3\frac{3}{4}=\frac{15}{4}$	8. $5\frac{1}{2}=\frac{11}{2}$
9. $2\frac{4}{5}=\frac{14}{5}$	10. $5\frac{1}{3}=\frac{16}{3}$	11. $7\frac{1}{2}=\frac{15}{2}$	12. $2\frac{7}{8}=\frac{23}{8}$

Exercise 34

Read each and name the result.

1. A 2-foot rope will make how many half-foot pieces?

2. A $5 note is worth how many quarter dollars?

3. A piece of cloth 2 yd. long can be cut into how many pieces each $\frac{1}{8}$ of a yard long?

4. A $\$2\frac{1}{2}$ gold piece is worth how many half dollars?

5. How many one eighth pound packages can be made from $1\frac{7}{8}$ pounds of drugs?

6. A line $5\frac{1}{2}$ yd. long will make how many half-yard lines?

7. How many times will $4\frac{1}{2}$ bu. of potatoes fill a half-bushel measure?

8. $\$12\frac{1}{2}$ in half dollars make how many half dollars?

9. $\$5\frac{1}{4}$ in quarter dollars make how many quarter dollars?

10. $\$2\frac{1}{2}$ in quarter dollars make how many quarter dollars?

Exercise 35

1. Reduce $18\frac{3}{4}$ to an improper fraction.

This shows the complete work:

$1 = \frac{4}{4}$

$18 = 18 \times \frac{4}{4}$, or $\frac{72}{4}$

$18\frac{3}{4} = \frac{72}{4} + \frac{3}{4}$, or $\frac{75}{4}$

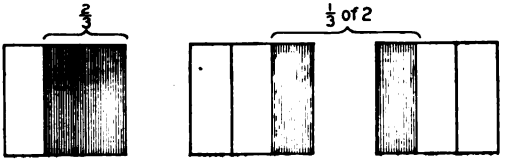
The answer may be found thus:

$$\begin{array}{r} 18 \\ \frac{4}{72} \\ \frac{3}{75} \\ \hline 4 \end{array}$$

Reduce to improper fractions:

2. $24\frac{1}{3}$	3. $33\frac{1}{3}$	4. $66\frac{2}{3}$	5. $48\frac{3}{4}$
6. $16\frac{1}{4}$	7. $37\frac{1}{2}$	8. $62\frac{1}{2}$	9. $87\frac{1}{2}$
10. $15\frac{5}{6}$	11. $22\frac{2}{9}$	12. $44\frac{4}{9}$	13. $55\frac{5}{9}$
14. $14\frac{2}{7}$	15. $77\frac{7}{9}$	16. $28\frac{4}{7}$	17. $18\frac{5}{12}$
18. $56\frac{3}{8}$	19. $87\frac{3}{4}$	20. $86\frac{7}{16}$	21. $105\frac{7}{12}$

Reducing Improper Fractions to Whole or Mixed Numbers



Here we see that: $\frac{2}{3} = \frac{1}{3}$ of 2, or $2 \div 3$.

56. A fraction may be considered to denote that the numerator is to be divided by the denominator.

Exercise 36

Reduce the following at sight to whole or mixed numbers:

1. $\frac{9}{4}$ Thus, $\frac{9}{4}$ equals $\frac{1}{4}$ of 9, or $2\frac{1}{4}$.

2. $\frac{8}{2}$	3. $\frac{9}{3}$	4. $\frac{31}{5}$	5. $\frac{18}{5}$
6. $\frac{20}{8}$	7. $\frac{15}{7}$	8. $\frac{25}{6}$	9. $\frac{14}{4}$
10. $\frac{17}{3}$	11. $\frac{17}{4}$	12. $\frac{21}{4}$	13. $\frac{25}{5}$

Exercise 37

Read each and name the result:

1. 8 half bushels of potatoes will fill how many bushel sacks?

2. 7 quarter days are how many days?

3. Twelve silver half dollars can be exchanged for how many dollar bills?

4. How many quarts of cream are needed to fill 16 one eighth quart bottles?

5. 15 quarter pecks of seed are how many pecks?

6. How many tons of coal will be required to give 21 families each a quarter of a ton?

7. 39 quarter dollars are worth how many dollars?

8. How many yards of ribbon are required to make 40 pieces, each one eighth of a yard long?

Exercise 38

1. Reduce $\frac{100}{3}$ to a mixed number.

This shows the complete work: $\frac{100}{3} = 3\overline{)100}$, $33\frac{1}{3}$

In practice write only this: $3\overline{)100}$, $33\frac{1}{3}$

Reduce to a whole or mixed number:

2. $\frac{89}{4}$	3. $\frac{100}{8}$	4. $\frac{96}{6}$	5. $\frac{242}{5}$
6. $\frac{312}{4}$	7. $\frac{581}{3}$	8. $\frac{348}{10}$	9. $\frac{673}{12}$
10. $\frac{592}{4}$	11. $\frac{1001}{11}$	12. $\frac{250}{8}$	13. $\frac{375}{4}$
14. $\frac{208}{6}$	15. $\frac{425}{5}$	16. $\frac{654}{3}$	17. $\frac{576}{4}$
18. $\frac{673}{8}$	19. $\frac{326}{7}$	20. $\frac{976}{5}$	21. $\frac{787}{9}$

Reducing Fractions to Lowest Terms

57. A fraction is said to be in its **lowest terms** when its numerator and denominator have no common divisor except 1.

Thus, $\frac{4}{9}$ is in its lowest terms, since 4 and 9 have no common divisor except 1.

Exercise 39

Reduce at sight each of the following to its lowest terms:

1. $\frac{8}{12}$

SUGGESTION. — Divide both numerator and denominator by their greatest common divisor when it can be readily seen.

2. $\frac{8}{10}$ 3. $\frac{12}{15}$ 4. $\frac{16}{20}$ 5. $\frac{24}{36}$ 6. $\frac{18}{24}$

7. $\frac{12}{16}$ 8. $\frac{4}{12}$ 9. $\frac{15}{20}$ 10. $\frac{14}{21}$ 11. $\frac{9}{12}$

12. $\frac{9}{15}$ 13. $\frac{6}{24}$ 14. $\frac{30}{48}$ 15. $\frac{56}{64}$ 16. $\frac{25}{40}$

17. $\frac{36}{60}$ 18. $\frac{35}{49}$ 19. $\frac{42}{63}$ 20. $\frac{32}{56}$ 21. $\frac{132}{144}$

Exercise 40

Reduce to lowest terms:

1. $\frac{210}{336}$

$$\frac{2)210}{2)336} = \frac{3)105}{3)168} = \frac{7)35}{7)56} = \frac{5}{8}$$

Divide both terms by common divisors of them that are easily observed. Shorten the work by using as great common divisors as possible.

2. $\frac{45}{60}$ 3. $\frac{98}{168}$ 4. $\frac{72}{288}$ 5. $\frac{125}{175}$ 6. $\frac{36}{288}$

7. $\frac{100}{120}$ 8. $\frac{180}{195}$ 9. $\frac{168}{175}$ 10. $\frac{144}{288}$ 11. $\frac{105}{150}$

12. $\frac{84}{288}$ 13. $\frac{108}{240}$ 14. $\frac{100}{250}$ 15. $\frac{275}{300}$ 16. $\frac{120}{128}$

17. $\frac{128}{144}$ 18. $\frac{280}{320}$ 19. $\frac{165}{180}$ 20. $\frac{500}{750}$ 21. $\frac{600}{1000}$

Reducing Fractions to a Common Denominator

58. Fractions that have the same number for a denominator are said to have a **common denominator.**

Thus, $\frac{1}{4}$ and $\frac{3}{4}$ have a common denominator.

59. Fractions that have a common denominator are called **similar fractions.**

Thus, $\frac{2}{5}$ and $\frac{4}{5}$ are similar fractions.

Exercise 41

Reduce:

1. $\frac{2}{3}$, $\frac{1}{4}$, and $\frac{5}{6}$ to 12ths.

Thus,

$12 = 4 \times 3 = 3 \times 4 = 2 \times 6$

$$\frac{2}{3} = \frac{4 \times 2}{4 \times 3} = \frac{8}{12}$$

$$\frac{1}{4} = \frac{3 \times 1}{3 \times 4} = \frac{3}{12}$$

$$\frac{5}{6} = \frac{2 \times 5}{2 \times 6} = \frac{10}{12}$$

How may we find the number by which both terms of $\frac{2}{3}$ must be multiplied? both terms of $\frac{1}{4}$? both terms of $\frac{5}{6}$?

2. $\frac{3}{5}$ and $\frac{2}{3}$ to 15ths.
3. $\frac{4}{5}$ and $\frac{3}{4}$ to 20ths.
4. $\frac{1}{2}$ and $\frac{3}{4}$ to 8ths.
5. $\frac{5}{9}$ and $\frac{5}{6}$ to 18ths.
6. $\frac{3}{10}$ and $\frac{3}{20}$ to 100ths.
7. $\frac{3}{4}$ and $\frac{1}{6}$ to 36ths.
8. $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{1}{2}$ to 12ths.
9. $\frac{4}{5}$, $\frac{2}{3}$, and $\frac{9}{10}$ to 30ths.
10. $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{3}{5}$ to 20ths.
11. $\frac{2}{3}$, $\frac{1}{4}$, and $\frac{3}{8}$ to 24ths.
12. $\frac{1}{3}$, $\frac{3}{4}$, and $\frac{4}{5}$ to 60ths.
13. $\frac{5}{6}$, $\frac{1}{9}$, and $\frac{3}{8}$ to 72ds.

Reducing Fractions to their Least Common Denominator

60. The **least common denominator** (l. c. d.) of two or more fractions in their lowest terms is the least number that their denominators will divide.

Thus, the least common denominator of $\frac{2}{3}$, $\frac{1}{4}$, and $\frac{5}{6}$ is 12; for 12 is the least number that 3, 4, and 6 will divide.

Exercise 42

Reduce to fractions having the least common denominator:

1. $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$.

Thus, the l. c. d. of $\frac{2}{3}$, $\frac{1}{4}$, and $\frac{5}{6}$ is 12.

$$\frac{2}{3}=\frac{4\times 2}{4\times 3}=\frac{8}{12}$$

$$\frac{3}{4}=\frac{3\times 3}{3\times 4}=\frac{9}{12}$$

$$\frac{5}{6}=\frac{2\times 5}{2\times 6}=\frac{10}{12}$$

2. $\frac{2}{3}$, $\frac{3}{4}$
3. $\frac{3}{4}$, $\frac{4}{5}$
4. $\frac{4}{5}$, $\frac{5}{6}$
5. $\frac{2}{3}$, $\frac{3}{5}$
6. $\frac{4}{5}$, $\frac{7}{10}$
7. $\frac{5}{6}$, $\frac{8}{9}$
8. $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$
9. $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$
10. $\frac{2}{3}$, $\frac{1}{6}$, $\frac{2}{9}$
11. $\frac{3}{5}$, $\frac{1}{2}$, $\frac{3}{4}$
12. $\frac{7}{8}$, $\frac{5}{12}$, $\frac{2}{3}$
13. $\frac{5}{6}$, $\frac{1}{2}$, $\frac{2}{9}$
14. $\frac{2}{5}$, $\frac{7}{10}$, $\frac{1}{2}$
15. $\frac{3}{5}$, $\frac{3}{10}$, $\frac{2}{15}$
16. $\frac{7}{8}$, $\frac{5}{16}$, $\frac{3}{4}$
17. $\frac{1}{6}$, $\frac{1}{2}$, $\frac{2}{5}$
18. $\frac{7}{12}$, $\frac{3}{8}$, $\frac{5}{6}$
19. $\frac{2}{5}$, $\frac{1}{25}$, $\frac{3}{50}$
20. $\frac{2}{9}$, $\frac{3}{4}$, $\frac{5}{6}$
21. $\frac{7}{8}$, $\frac{5}{12}$, $\frac{5}{9}$
22. $\frac{3}{10}$, $\frac{5}{6}$, $\frac{7}{12}$
23. $\frac{3}{7}$, $\frac{7}{8}$, $\frac{3}{4}$
24. $\frac{5}{12}$, $\frac{7}{8}$, $\frac{3}{16}$
25. $\frac{3}{25}$, $\frac{3}{50}$, $\frac{3}{20}$
26. $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$
27. $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$
28. $\frac{1}{2}$, $\frac{2}{5}$, $\frac{3}{4}$, $\frac{7}{10}$

ADDITION AND SUBTRACTION

Addition of Similar Fractions

61. Draw lines and show that:

1. $\frac{1}{4}+\frac{2}{4}=\frac{3}{4}$; that is, $\frac{1+2}{4}$
2. $\frac{2}{8}+\frac{6}{8}=\frac{8}{8}$; that is, $\frac{2+6}{8}$, or 1
3. $\frac{3}{10}+\frac{5}{10}=\frac{8}{10}$; that is, $\frac{3+5}{10}$, or $\frac{4}{5}$
4. $\frac{9}{12}+\frac{7}{12}=\frac{16}{12}$; that is, $\frac{9+7}{12}$, or $1\frac{1}{3}$

To add similar fractions, add their numerators, and place the result over their common denominator.

Exercise 43

Add at sight:

1. $\frac{1}{5}+\frac{2}{5}$	2. $\frac{1}{4}+\frac{3}{4}$	3. $\frac{2}{5}+\frac{3}{5}$
4. $\frac{5}{6}+\frac{1}{6}$	5. $\frac{3}{8}+\frac{1}{8}$	6. $\frac{3}{8}+\frac{5}{8}$
7. $\frac{3}{8}+\frac{6}{8}$	8. $\frac{3}{8}+\frac{7}{8}$	9. $\frac{7}{12}+\frac{5}{12}$
10. $\frac{7}{12}+\frac{3}{12}$	11. $\frac{1}{12}+\frac{5}{12}$	12. $\frac{3}{12}+\frac{15}{12}$
13. $\frac{1}{10}+\frac{9}{10}$	14. $\frac{1}{10}+\frac{11}{10}$	15. $\frac{7}{10}+\frac{8}{10}$
16. $\frac{5}{24}+\frac{7}{24}$	17. $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$	18. $\frac{1}{3}+\frac{1}{3}+\frac{2}{3}$
19. $\frac{1}{4}+\frac{1}{4}+\frac{3}{4}$	20. $\frac{1}{5}+\frac{2}{5}+\frac{2}{5}$	21. $\frac{2}{5}+\frac{2}{5}+\frac{4}{5}$
22. $\frac{7}{8}+\frac{1}{8}+\frac{3}{8}$	23. $\frac{1}{10}+\frac{1}{10}+\frac{3}{10}$	24. $\frac{1}{12}+\frac{7}{12}+\frac{5}{12}$

Addition of Fractions that are not Similar

62. Draw lines and show that:

1. $\frac{1}{2}+\frac{1}{4}=\frac{2}{4}+\frac{1}{4}=\frac{3}{4}$.

What is the l. c. d. of $\frac{1}{2}$ and $\frac{1}{4}$?

2. $\frac{1}{3}+\frac{1}{2}=\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$.

What is the l. c. d. of $\frac{1}{3}$ and $\frac{1}{2}$?

3. $\frac{2}{3}+\frac{3}{4}=\frac{8}{12}+\frac{9}{12}=\frac{17}{12}$, or $1\frac{5}{12}$.

What is the l. c. d. of $\frac{2}{3}$ and $\frac{3}{4}$?

To add fractions with unlike denominators, reduce them to similar fractions having the least common denominator, and add the similar fractions.

Exercise 44

Find the sum:

1. $\frac{1}{2}+\frac{1}{4}$	2. $\frac{1}{2}+\frac{1}{8}$	3. $\frac{1}{4}+\frac{1}{8}$
4. $\frac{1}{3}+\frac{1}{6}$	5. $\frac{1}{3}+\frac{1}{9}$	6. $\frac{1}{4}+\frac{1}{12}$
7. $\frac{1}{6}+\frac{1}{12}$	8. $\frac{1}{5}+\frac{1}{10}$	9. $\frac{1}{5}+\frac{1}{15}$
10. $\frac{1}{2}+\frac{1}{3}$	11. $\frac{1}{6}+\frac{1}{4}$	12. $\frac{1}{2}+\frac{1}{5}$
13. $\frac{1}{3}+\frac{1}{5}$	14. $\frac{1}{4}+\frac{1}{5}$	15. $\frac{1}{6}+\frac{1}{8}$
16. $\frac{1}{6}+\frac{1}{9}$	17. $\frac{1}{8}+\frac{1}{12}$	18. $\frac{1}{4}+\frac{1}{10}$
19. $\frac{1}{2}+\frac{2}{3}$	20. $\frac{1}{2}+\frac{3}{4}$	21. $\frac{1}{2}+\frac{3}{8}$
22. $\frac{2}{3}+\frac{1}{6}$	23. $\frac{2}{3}+\frac{5}{6}$	24. $\frac{3}{4}+\frac{5}{8}$
25. $\frac{3}{4}+\frac{7}{8}$	26. $\frac{2}{3}+\frac{3}{8}$	27. $\frac{3}{4}+\frac{5}{6}$

63. 1. When the l. c. d. of two or more fractions cannot readily be seen, as in $\frac{7}{12}$, $\frac{5}{8}$, and $\frac{9}{20}$, it may be found thus:

$12 = 2 \times 2 \times 3$
$8 = 2 \times 2 \times 2$
$20 = 2 \times 2 \times 5$
l. c. d. $= 2 \times 2 \times 2 \times 3 \times 5$, or 120

The l. c. d. must have in it the prime factors 2, 2, and 3, in order that 12 may divide it; it must have in it the additional prime factor 2, in order that 8 may divide it, and the additional prime factor 5, in order that 20 may divide it.

Now, $120 \div 12 = 10$; $120 \div 8 = 15$; $120 \div 20 = 6$

$120 = 10 \times 12$, 15×8, or 6×20.

$$\frac{7}{12} = \frac{10 \times 7}{10 \times 12} = \frac{70}{120}$$

$$\frac{5}{8} = \frac{15 \times 5}{15 \times 8} = \frac{75}{120}$$

$$\frac{9}{20} = \frac{6 \times 9}{6 \times 20} = \frac{54}{120}$$

2. Find the sum of $\frac{3}{8}$, $\frac{3}{4}$, and $\frac{4}{5}$.

l. c. d. $= 40$.

$$\frac{3}{8} = \frac{5 \times 3}{5 \times 8} = \frac{15}{40}$$

$$\frac{3}{4} = \frac{10 \times 3}{10 \times 4} = \frac{30}{40}$$

$$\frac{4}{5} = \frac{8 \times 4}{8 \times 5} = \frac{32}{40}$$

Sum $= \frac{77}{40} = 1\frac{37}{40}$.

Exercise 45

Find the sum:

1. $\frac{5}{12}+\frac{7}{8}$
2. $\frac{9}{10}+\frac{2}{15}$
3. $\frac{5}{8}+\frac{11}{12}$
4. $\frac{7}{8}+\frac{5}{6}$
5. $\frac{5}{12}+\frac{3}{16}$
6. $\frac{3}{16}+\frac{7}{24}$
7. $\frac{3}{16}+\frac{9}{32}$
8. $\frac{7}{16}+\frac{5}{48}$
9. $\frac{5}{16}+\frac{3}{64}$
10. $\frac{5}{18}+\frac{23}{24}$
11. $\frac{9}{16}+\frac{27}{40}$
12. $\frac{9}{15}+\frac{24}{25}$
13. $\frac{7}{20}+\frac{19}{25}$
14. $\frac{17}{25}+\frac{19}{30}$
15. $\frac{25}{32}+\frac{5}{24}$
16. $\frac{19}{30}+\frac{17}{40}$
17. $\frac{2}{3}+\frac{4}{5}+\frac{1}{6}$
18. $\frac{7}{8}+\frac{3}{4}+\frac{1}{2}$
19. $\frac{9}{10}+\frac{4}{5}+\frac{7}{15}$
20. $\frac{3}{4}+\frac{5}{6}+\frac{7}{16}$
21. $\frac{5}{8}+\frac{7}{12}+\frac{9}{16}$
22. $\frac{7}{24}+\frac{5}{16}+\frac{3}{8}$
23. $\frac{17}{24}+\frac{9}{16}+\frac{7}{12}$
24. $\frac{13}{20}+\frac{11}{30}+\frac{11}{12}$

Subtraction of Similar Fractions

64. Draw figures and show that:

1. $\frac{6}{8}-\frac{1}{8}=\frac{5}{8}$; that is, $\frac{6-1}{8}$

2. $\frac{10}{12}-\frac{6}{12}=\frac{4}{12}$; that is, $\frac{10-6}{12}$, or $\frac{1}{3}$

3. $\frac{5}{3}-\frac{2}{3}=\frac{3}{3}$; that is, $\frac{5-2}{3}$, or 1

To subtract two similar fractions, subtract their numerators, place the result over their common denominator, and reduce, if possible.

Exercise 46

Subtract at sight:

1. $\frac{4}{4}-\frac{1}{4}$	2. $\frac{5}{6}-\frac{1}{6}$	3. $\frac{7}{8}-\frac{3}{8}$
4. $\frac{5}{2}-\frac{3}{2}$	5. $\frac{8}{4}-\frac{2}{4}$	6. $\frac{9}{12}-\frac{3}{12}$
7. $\frac{7}{6}-\frac{1}{6}$	8. $\frac{5}{6}-\frac{3}{6}$	9. $\frac{12}{12}-\frac{3}{12}$
10. $\frac{12}{12}-\frac{6}{12}$	11. $\frac{9}{12}-\frac{5}{12}$	12. $\frac{7}{16}-\frac{5}{16}$
13. $\frac{11}{12}-\frac{7}{12}$	14. $\frac{9}{24}-\frac{3}{24}$	15. $\frac{15}{18}-\frac{6}{18}$
16. $\frac{19}{24}-\frac{7}{24}$	17. $\frac{15}{24}-\frac{11}{24}$	18. $\frac{21}{30}-\frac{6}{30}$

Subtraction of Fractions that are not Similar

65. Draw figures and show that:

1. $\frac{3}{8}-\frac{1}{4}=\frac{3}{8}-\frac{2}{8}=\frac{1}{8}$.

   What is the l. c. d. of $\frac{3}{8}$ and $\frac{1}{4}$?

2. $\frac{5}{6}-\frac{3}{4}=\frac{20}{24}-\frac{18}{24}=\frac{2}{24}$, or $\frac{1}{12}$.

   What is the l. c. d. of $\frac{5}{6}$ and $\frac{3}{4}$?

To subtract two fractions with unlike denominators, reduce them to similar fractions having the least common denominator, subtract the similar fractions, and reduce, if possible.

66. Find the difference of $\frac{8}{15}$ and $\frac{3}{10}$.

l. c. d. = 60.

$$\frac{8}{15}=\frac{4\times 8}{4\times 15}=\frac{32}{60}$$

$$\frac{3}{10}=\frac{6\times 3}{6\times 10}=\frac{18}{60}$$

$$\text{Difference} = \frac{14}{60}=\frac{7}{30}$$

Exercise 47

Find the difference of:

1. $\frac{3}{4}$ and $\frac{2}{3}$	2. $\frac{4}{5}$ and $\frac{3}{4}$	3. $\frac{7}{8}$ and $\frac{5}{6}$
4. $\frac{7}{12}$ and $\frac{3}{8}$	5. $\frac{5}{4}$ and $\frac{5}{6}$	6. $\frac{3}{2}$ and $\frac{2}{5}$
7. $\frac{15}{16}$ and $\frac{3}{4}$	8. $\frac{17}{30}$ and $\frac{13}{45}$	9. $\frac{7}{24}$ and $\frac{5}{36}$
10. $\frac{8}{25}$ and $\frac{3}{50}$	11. $\frac{8}{9}$ and $\frac{2}{3}$	12. $\frac{5}{6}$ and $\frac{7}{9}$
13. $\frac{11}{27}$ and $\frac{5}{18}$	14. $\frac{13}{50}$ and $\frac{4}{75}$	15. $\frac{13}{24}$ and $\frac{13}{40}$

Problems

Exercise 48

1. If A can do $\frac{1}{2}$ of a piece of work in one day, B $\frac{1}{4}$ of it in one day, and C $\frac{1}{8}$ of it in one day, what part of it can they together do in one day?

$\frac{1}{2}$ = the part A can do in a day.
$\frac{1}{4}$ = the part B can do in a day.
$\frac{1}{8}$ = the part C can do in a day.
$\therefore \frac{1}{2}+\frac{1}{4}+\frac{1}{8}$, or $\frac{7}{8}$ = the part they together can do in a day.

NOTE. — The symbol $\therefore$ is read therefore.

2. A can do $\frac{2}{3}$ of a piece of work in one day, and A and B together can do $\frac{7}{8}$ of it; what part can B do in one day?

$\frac{2}{3}$ = the part A can do in one day.
$\frac{7}{8}$ = the part A and B together can do in one day.
$\therefore \frac{7}{8}-\frac{2}{3}$, or $\frac{5}{24}$ = the part B can do in one day.

3. If a man does $\frac{1}{5}$ of a piece of work one day and $\frac{1}{4}$ of it another day, what part of it has he then done?

4. A storekeeper sold at auction $\frac{1}{5}$ of his stock and at a private sale $\frac{3}{10}$ of it; what part did he sell at both?

5. How much oats is required to feed one horse $\frac{3}{8}$ of a bushel and another $\frac{3}{4}$ of a bushel?

6. A farmer planted $\frac{1}{2}$ of an acre with potatoes, $\frac{1}{3}$ of an acre with tobacco, and $\frac{1}{4}$ of an acre with sweet corn. How much did he plant in all?

7. How much land do three lots contain if their sizes are $\frac{5}{6}$ of an acre, $\frac{3}{8}$ of an acre, and $\frac{5}{12}$ of an acre?

8. A piece of cloth $\frac{7}{8}$ of a yard long shrunk $\frac{1}{16}$ of a yard in sponging; how long was it then?

9. A can do $\frac{1}{2}$ of a piece of work in one day, and A and B together $\frac{5}{6}$ of it; what part can B do in a day?

10. In a township, there were built in one year, four pieces of good roads, the first $\frac{5}{8}$ of a mile, the second $\frac{3}{4}$ of a mile, the third $\frac{5}{6}$ of a mile, and the fourth $\frac{1}{2}$ of a mile; how much was built in all?

11. A man bought an article for $\$\frac{3}{4}$ and sold it at a profit of $\$\frac{1}{2}$; how much did he receive for it?

12. A man bought an article for $\$\frac{3}{4}$ and sold it at a loss of $\$\frac{1}{20}$; what part of a dollar did he receive for it?

13. If one oil lamp burns $\frac{1}{8}$ of a gallon of oil in a night, another burns $\frac{3}{4}$ of a gallon, and a third burns $\frac{1}{2}$ of a gallon, how much do they all burn?

14. If A can cut $\frac{3}{8}$ of an acre of corn in a day, and his son can cut $\frac{3}{4}$ of an acre, how much can they both cut in a day?

15. A man bought an article at $\$\frac{4}{5}$ and sold it at a profit of $\$\frac{1}{20}$; how much did he receive for it?

16. A man sold an article for $\$\frac{3}{4}$, which was at a loss of $\$\frac{1}{20}$; what part of a dollar did it cost?

17. A man sold an article for $\$\frac{4}{5}$, which was at a gain of $\$\frac{1}{20}$; what part of a dollar did it cost?

Addition and Subtraction of Mixed Numbers

67. 1. Find the sum of $124\frac{7}{8}$, $346\frac{5}{16}$, and $452\frac{7}{32}$.

Form

$124\frac{7}{8} = 124\frac{28}{32}$
$346\frac{5}{16} = 346\frac{10}{32}$
$452\frac{7}{32} = 452\frac{7}{32}$
$\therefore$ Sum $= 923\frac{13}{32}$

SUGGESTION. — The sum of the fractions equals $1\frac{13}{32}$. Write the $\frac{13}{32}$, add the 1 to the column of units, and proceed as in addition of whole numbers.

2. Find the difference of $124\frac{3}{8}$ and $98\frac{3}{4}$.

Form

$124\frac{3}{8} = 123\frac{11}{8}$
$98\frac{3}{4} = 98\frac{6}{8}$
$\therefore$ Diff. $= 25\frac{5}{8}$

SUGGESTION. — Since $\frac{3}{4}$ is more than $\frac{3}{8}$, take *one* from 124 and add it to $\frac{3}{8}$ before subtracting.

Exercise 49

Find the sum:

1. $2\frac{3}{8} + 3\frac{5}{16}$
2. $7\frac{1}{12} + 6\frac{5}{6}$
3. $8\frac{3}{8} + 10\frac{2}{3}$
4. $12\frac{3}{4} + 5\frac{1}{32}$
5. $24\frac{7}{8} + 19\frac{3}{16}$
6. $56\frac{5}{24} + 32\frac{15}{16}$
7. $12\frac{1}{2} + 13\frac{2}{3} + 15\frac{1}{6}$
8. $16\frac{2}{3} + 12\frac{1}{2} + 18\frac{3}{4}$
9. $42\frac{2}{7} + 35\frac{5}{14} + 40\frac{2}{21}$
10. $15\frac{2}{3} + 18\frac{1}{6} + 20\frac{3}{4}$
11. $28\frac{2}{3} + 19\frac{3}{8} + 56\frac{5}{12}$
12. $16\frac{1}{6} + 33\frac{1}{3} + 66\frac{2}{3}$

Find the difference:

13. $100 - 33\frac{1}{3}$
14. $66\frac{2}{3} - 12\frac{1}{2}$
15. $86\frac{1}{2} - 18\frac{3}{4}$
16. $33\frac{1}{3} - 16\frac{2}{3}$
17. $70\frac{1}{2} - 25\frac{5}{8}$
18. $85\frac{1}{8} - 32\frac{7}{16}$
19. $32\frac{5}{9} - 12\frac{2}{3}$
20. $56\frac{5}{6} - 32\frac{8}{9}$
21. $25\frac{7}{12} - 13\frac{5}{6}$
22. $128\frac{3}{10} - 39\frac{4}{5}$
23. $47\frac{3}{14} - 28\frac{2}{21}$
24. $100\frac{1}{9} - 37\frac{3}{8}$

Problems

Exercise 50

1. A man owned $37\frac{1}{2}$ acres of land and bought $32\frac{3}{4}$ acres more; how much had he then?

2. The four sides of a field measure $42\frac{1}{2}$ rods, 31 rods, $26\frac{1}{2}$ rods, and $38\frac{1}{2}$ rods; what is the distance around the field?

3. Find the weight of four hams, whose weights are $12\frac{3}{4}$ lb., $14\frac{1}{2}$ lb., $16\frac{3}{4}$ lb., and $15\frac{1}{2}$ lb.

4. What is the distance around a room whose length is $18\frac{3}{4}$ ft. and width $15\frac{3}{4}$ ft.?

5. A woman bought $37\frac{1}{2}$ yd. muslin and has used $18\frac{3}{4}$ yd. of it; how much remains?

6. From 40 yd. of carpet, 3 pieces were sold, whose lengths were $10\frac{1}{2}$ yd., $7\frac{3}{4}$ yd., and $8\frac{3}{4}$ yd.; how much remains?

7. How much change should a woman receive from 2 fifty-dollar bills given in payment of a bill of $\$ 72\frac{1}{2}$?

8. $20\frac{3}{4}$ lb. of lard was put into a can weighing $3\frac{1}{2}$ lb.; what was the weight of both?

9. From a barrel containing 42 gallons of oil, $14\frac{1}{2}$ gallons were sold; how much then remained?

10. The width of a lot is $42\frac{3}{4}$ yd., and its length is $8\frac{3}{4}$ yd. more than its width; what is the distance around it?

11. From a 20-acre tract of land, 3 lots have been sold, containing $2\frac{1}{2}$ acres, $3\frac{5}{8}$ acres, and $6\frac{3}{4}$ acres; how much remains?

12. If a man owes me $\$ 37\frac{1}{2}$ and gives me three five-dollar bills and a $\$ 2\frac{1}{2}$ gold piece, how much does he still owe me?

13. What number must be added to $37\frac{1}{2}$ to make 100?

14. By how much does 200 exceed the sum of $66\frac{2}{3} + 33\frac{1}{3} + 12\frac{1}{2}$?

15. When $\frac{7}{30}$ of June has passed, what part of it remains?

REVIEW

Exercise 51

1. A farmer hauled a load of wheat weighing $2\frac{3}{16}$ tons in a wagon weighing $1\frac{4}{5}$ tons; what weight did he haul?

2. There are three slates in a certain blackboard; the first is $4\frac{2}{3}$ ft. long, the second $3\frac{3}{4}$ ft. long, and the third $5\frac{1}{8}$ ft. long; how long is the blackboard?

3. If a train runs $16\frac{2}{3}$ miles in one hour, $18\frac{3}{4}$ miles the next hour, and $17\frac{5}{6}$ miles the next hour, how far does it run in the three hours?

4. Mr. Smith bought $\frac{1}{24}$ of a certain tract of land, and Mr. Jones $\frac{1}{36}$ of it; what part of it did they together buy?

5. Mr. Hill gave $\frac{1}{16}$ of his money to a church, $\frac{1}{24}$ of it to a hospital, and $\frac{1}{12}$ of it to a college; what part of it did he give away?

6. 3 turkeys together weighed $24\frac{3}{4}$ lb.; if one of them weighed $8\frac{3}{4}$ lb. and the other 8 lb., what did the third weigh?

7. A farmer sold two cans of lard, one weighing $35\frac{3}{4}$ lb., the other $32\frac{1}{2}$ lb. One can weighed $2\frac{3}{4}$ lb., the other 2 lb.; what was the weight of the lard?

8. What change should you receive from two twenty-dollar bills given in payment for a suit of clothes costing \$ 27.50?

9. Find the sum of $12\frac{1}{2}$, $37\frac{1}{2}$, $62\frac{1}{2}$, and $87\frac{1}{2}$.

10. Arrange the following fractions in the order of their value, the largest first to the left: $\frac{1}{2}$, $\frac{5}{6}$, $\frac{8}{9}$, $\frac{9}{10}$, $\frac{9}{15}$.

11. A man bought a box of fruit for \$ $2\frac{3}{4}$ and sold it at a profit of \$ $1\frac{1}{2}$; what did he receive for it?

12. How many rods of fence are required to inclose a field whose length is $16\frac{2}{3}$ rods and width $12\frac{1}{2}$ rods?

13. From a log 80 ft. long, two pieces were cut, the first $10\frac{3}{4}$ ft. long and the second $8\frac{1}{2}$ ft. long; what was the length of the piece remaining?

14. A telegraph pole 60 ft. long was set $5\frac{3}{4}$ ft. in the ground; how many feet of it were above ground?

15. A man has a $\$2\frac{1}{2}$ gold piece and $\$3\frac{3}{4}$ in silver; how much more money does he need to have \$10?

16. An 8-inch spike was driven through a $2\frac{1}{2}$-inch plank into a log; how far did it extend into the log?

17. A foundation $32\frac{1}{2}$ ft. long and 24 ft. wide was dug for a cellar; what was the distance around the foundation?

18. By how much does the sum of $12\frac{1}{2}$ and 75 exceed the sum of $37\frac{1}{2}$ and 25?

19. What average mark should a girl receive in Arithmetic, Grammar, and Drawing, if her mark in Arithmetic was $87\frac{1}{4}$, in Grammar $88\frac{1}{4}$, and in Drawing $90\frac{1}{2}$?

20. Find the cost of a horse that sold for \$150 at a loss of $\$37\frac{1}{2}$.

21. Find the selling price of a rope and pulley that were sold at a profit of $\$\frac{2}{5}$, the pulley costing $\$1\frac{1}{2}$ and the rope $\$1\frac{1}{4}$.

22. Simplify: $(37\frac{1}{2}+18\frac{3}{4}+62\frac{1}{2})-(66\frac{2}{3}+6\frac{1}{6})$.

23. If A can cut $\frac{3}{8}$ of an acre of corn in a day and B $\frac{3}{4}$ of an acre and C $1\frac{1}{4}$ acres, how much can they all cut in a day?

24. A man gave two \$2 bills and two \$5 bills in payment for a coat that cost him $\$12\frac{1}{2}$; how much change should he receive?

25. A grocer had in the drawer of his cash register, on opening business on a certain day, $\$32\frac{1}{2}$; he took in dur-

ing the day $\$ 112\frac{1}{4}$ and paid out $\$ 18\frac{3}{4}$; how much should the cash drawer contain at the close of business that day?

26. A laborer does $\frac{1}{6}$ of a piece of work in one day, $\frac{1}{4}$ of it the next day, and $\frac{1}{3}$ of it the next day; he finishes it the fourth day. What part of the work does he do the fourth day?

27. $\frac{1}{10}$ part of each of our gold coins is copper and the remaining part pure gold; what part is pure gold?

28. A clerk's expenses for a month were as follows: board $\$ 24$, laundry $\$ 3\frac{3}{4}$, carfare $\$ 2\frac{1}{2}$, and other expenses $\$ 7\frac{1}{2}$; what does he save out of his salary of $\$ 60$?

29. I bought a horse for $\$ 150$, paid in cash $\$ 62\frac{1}{2}$ and the balance in six months. What amount did I pay in 6 months?

30. Supply the missing number:

$$10 + 62\tfrac{1}{2} + 30 + ? + 8\tfrac{1}{2} = 250.$$

MULTIPLICATION

Multiplying a Fraction by a Whole Number

68. Here we see that:

$$2 \times \tfrac{3}{8} = \frac{6}{8} = \frac{2 \times 3}{8}$$

Also, $$2 \times \tfrac{3}{8} = \frac{3}{4} = \frac{3}{8 \div 2}$$

To multiply a fraction by a whole number, multiply the numerator or divide the denominator by the whole number.

NOTE. — Divide the denominator when possible.

Exercise 52

Name at sight the product:

1. $2 \times \frac{1}{2}$	2. $2 \times \frac{2}{5}$	3. $2 \times \frac{3}{4}$
4. $3 \times \frac{2}{9}$	5. $3 \times \frac{3}{4}$	6. $3 \times \frac{4}{9}$
7. $3 \times \frac{2}{3}$	8. $4 \times \frac{1}{8}$	9. $4 \times \frac{5}{12}$
10. $4 \times \frac{2}{7}$	11. $4 \times \frac{7}{12}$	12. $4 \times \frac{3}{9}$
13. $4 \times \frac{5}{6}$	14. $5 \times \frac{1}{5}$	15. $5 \times \frac{3}{5}$
16. $5 \times \frac{1}{3}$	17. $5 \times \frac{2}{3}$	18. $5 \times \frac{3}{25}$
19. $5 \times \frac{7}{30}$	20. $5 \times \frac{11}{10}$	21. $6 \times \frac{1}{6}$
22. $6 \times \frac{1}{12}$	23. $6 \times \frac{5}{6}$	24. $6 \times \frac{7}{12}$
25. $6 \times \frac{5}{18}$	26. $8 \times \frac{5}{8}$	27. $8 \times \frac{3}{16}$
28. $8 \times \frac{3}{10}$	29. $8 \times \frac{7}{8}$	30. $9 \times \frac{5}{9}$

Exercise 53

1. If each side of a square is $\frac{3}{8}$ in. long, what is the distance around it?

2. Find the cost of 4 yd. of muslin at $\$\frac{1}{8}$ a yard.

3. What does a boy pay for 20 newspapers at $\frac{1}{2}¢$ each?

4. A boy that was paid $\$\frac{1}{10}$ for working an hour should be paid how much for working 10 hours?

5. How much milk is there in 4 bottles, each containing $\frac{1}{4}$ of a quart?

6. If a pound of green coffee loses $\frac{1}{10}$ of a pound in roasting, how much should 5 lb. lose?

7. If $\frac{3}{8}$ of an inch is taken to represent 1 foot, what should represent 4 feet?

8. What part of a piece of work should a man do in 4 days if he does $\frac{3}{16}$ of it in 1 day?

9. If a laborer cuts $\frac{7}{8}$ of an acre of corn in a day, how much should he cut in 8 days?

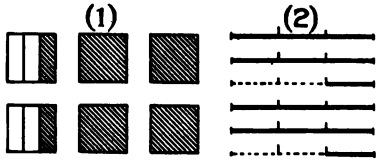
10. A lamp that burns $\frac{3}{8}$ of a quart of oil per night, burns how much in a week?

Multiplying a Mixed Number by a Whole Number

69. Here we see that:

(1) $2 \times 2\frac{1}{3} = 4\frac{2}{3}$.

(2) $2 \times 2\frac{1}{3} = 2 \times \frac{7}{3} = \frac{14}{3}$, or $4\frac{2}{3}$.



To multiply a mixed number by a whole number, multiply the whole number and the fractional part separately and add the products; or reduce the mixed number to an improper fraction and multiply.

Exercise 54

Multiply at sight:

1. $2 \times 1\frac{1}{3}$	2. $2 \times 1\frac{1}{2}$	3. $2 \times 1\frac{1}{4}$
4. $2 \times 1\frac{2}{5}$	5. $2 \times 1\frac{3}{8}$	6. $3 \times 1\frac{1}{3}$
7. $3 \times 2\frac{2}{3}$	8. $3 \times 2\frac{2}{7}$	9. $3 \times 2\frac{3}{7}$
10. $3 \times 2\frac{1}{2}$	11. $4 \times 1\frac{1}{4}$	12. $4 \times 3\frac{3}{4}$
13. $4 \times 2\frac{7}{8}$	14. $5 \times 3\frac{1}{5}$	15. $5 \times 4\frac{3}{10}$
16. $5 \times 2\frac{1}{2}$	17. $5 \times 7\frac{1}{2}$	18. $6 \times 2\frac{1}{2}$

Exercise 55

1. Find the length of 2 strips of carpet each $2\frac{1}{4}$ yd. long.

2. How far did a car run in three hours if it ran $12\frac{1}{4}$ miles each hour?

3. One and one eighth bushels of seed were sowed on each of 2 acres; how much was sowed on both?

4. If a boy reads on an average one page of a certain book in $1\frac{5}{6}$ minutes, what time will he require to read 5 pages?

5. What length of board is required to make 3 pieces of board each $2\frac{1}{2}$ ft. long?

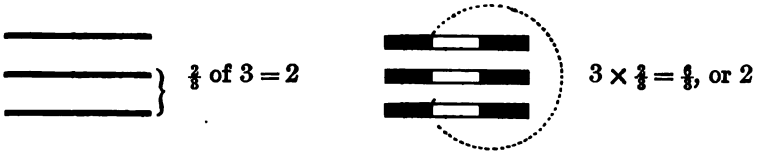
6. I bought three pieces of carpet each $12\frac{1}{2}$ yd. long, how much carpet did I buy?

Find the cost of:

7. 2 bushels of seed at $\$2\frac{1}{2}$ a bushel.
8. 6 lb. of sugar at $6\frac{1}{2}¢$ a pound.
9. 8 lb. of starch at $6\frac{1}{4}¢$ a pound.
10. 8 yd. of carpet at $\$2\frac{1}{4}$ a yard.
11. 4 yd. of calico at $8\frac{1}{4}¢$ a yard.
12. 6 oranges at $3\frac{1}{3}¢$ apiece.
13. 12 apples at $3\frac{1}{3}¢$ apiece.
14. 20 ft. of wire fencing at $1\frac{3}{10}¢$ a foot.
15. 3 yd. of serge at $\$1\frac{1}{2}$ a yard.
16. 4 yd. of carpet at $\$3\frac{1}{8}$ a yard.

Multiplying by a Fraction

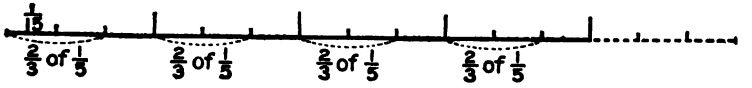
70. Here we see that $\frac{2}{3}$ of $3 = 3 \times \frac{2}{3}$.



NOTE. — $\frac{2}{3}$ of 3 and $\frac{2}{3} \times 3$ have the same meaning. The answer 2 is called the product.

To find the product of a whole number multiplied by a fraction, use the whole number as the multiplier.

71. Here we see that $\frac{2}{3}$ of $\frac{4}{5} = \frac{8}{15} = \frac{2 \times 4}{3 \times 5}$.



NOTE. — $\frac{2}{3}$ of $\frac{4}{5}$ and $\frac{2}{3} \times \frac{4}{5}$ have the same meaning. The answer $\frac{8}{15}$ is called the product.

The product of two fractions equals the product of their numerators divided by the product of their denominators.

Exercise 56

Multiply at sight:

1. $\frac{1}{4}$ of 3 Thus, $\frac{1}{4}$ of $3 = \frac{3}{4}$. [See Section 68.]
2. $\frac{1}{2}$ of 3
3. $\frac{1}{2}$ of 5
4. $\frac{1}{2}$ of 7
5. $\frac{1}{3}$ of 2
6. $\frac{1}{4}$ of 2
7. $\frac{1}{4}$ of 9
8. $\frac{1}{4}$ of 5
9. $\frac{1}{4}$ of 7
10. $\frac{1}{5}$ of 2
11. $\frac{1}{5}$ of 4
12. $\frac{1}{5}$ of 8
13. $\frac{1}{8}$ of 7

14. $\frac{1}{6}$ of 3	15. $\frac{1}{6}$ of 8	16. $\frac{2}{3}$ of 4
17. $\frac{2}{5}$ of 3	18. $\frac{2}{3}$ of 7	19. $\frac{3}{4}$ of 3
20. $\frac{3}{4}$ of 5	21. $\frac{3}{5}$ of 5	22. $\frac{3}{5}$ of 8
23. $\frac{4}{5}$ of 2	24. $\frac{4}{5}$ of 9	25. $\frac{5}{6}$ of 2
26. $\frac{5}{6}$ of 4	27. $\frac{5}{6}$ of 6	28. $\frac{2}{7}$ of 2
29. $\frac{2}{7}$ of 5	30. $\frac{1}{2}$ of $\frac{1}{3}$	31. $\frac{1}{2}$ of $\frac{1}{4}$
32. $\frac{1}{3}$ of $\frac{1}{4}$	33. $\frac{1}{2}$ of $\frac{1}{5}$	34. $\frac{1}{3}$ of $\frac{1}{5}$
35. $\frac{1}{2}$ of $\frac{2}{3}$	36. $\frac{2}{3}$ of $\frac{1}{4}$	37. $\frac{3}{4}$ of $\frac{1}{5}$
38. $\frac{1}{5}$ of $\frac{2}{3}$	39. $\frac{2}{3}$ of $\frac{1}{6}$	40. $\frac{2}{3}$ of $\frac{4}{5}$
41. $\frac{2}{3}$ of $\frac{3}{4}$	42. $\frac{2}{3}$ of $\frac{3}{2}$	43. $\frac{3}{4}$ of $\frac{4}{5}$

72. 1. Multiply 9 by $\frac{7}{24}$.

This shows the different steps:

$$\frac{7}{24} \times 9 = \frac{7 \times \overset{3}{\cancel{9}}}{\underset{8}{\cancel{24}}} = \frac{21}{8}, \text{ or } 2\tfrac{5}{8}$$

In practice write only this:

$$\frac{7}{\underset{8}{\cancel{24}}} \times \overset{3}{\cancel{9}} = \frac{21}{8}, \text{ or } 2\tfrac{5}{8}$$

To reduce the product to its lowest terms, we divide 9 and 24 by 3 and cancel the numbers divided.

2. Multiply $\frac{15}{16}$ by $\frac{8}{9}$.

This shows the different steps:

$$\frac{8}{9} \times \frac{15}{16} = \frac{\overset{1}{\cancel{8}} \times \overset{5}{\cancel{15}}}{\underset{3}{\cancel{9}} \times \underset{2}{\cancel{16}}} = \frac{1 \times 5}{3 \times 2} = \frac{5}{6}$$

In practice write only this:

$$\frac{\overset{1}{\cancel{8}}}{\underset{3}{\cancel{9}}} \times \frac{\overset{5}{\cancel{15}}}{\underset{2}{\cancel{16}}} = \frac{5}{6}$$

To reduce the product to its lowest terms, we divide 8 and 16 by 8, and 15 and 9 by 3, and cancel the numbers divided.

Exercise 57

Copy and multiply, expressing the answers in the simplest form:

1. $\frac{4}{5} \times \frac{10}{3}$	2. $\frac{4}{3} \times \frac{3}{5}$	3. $\frac{5}{6} \times \frac{3}{8}$
4. $\frac{2}{3} \times \frac{3}{4}$	5. $\frac{2}{9} \times \frac{6}{5}$	6. $\frac{14}{15} \times \frac{35}{48}$
7. $\frac{25}{24} \times \frac{16}{15}$	8. $\frac{9}{16} \times \frac{20}{21}$	9. $\frac{2}{3} \times \frac{3}{5}$
10. $\frac{3}{5} \times \frac{8}{3}$	11. $\frac{6}{7} \times \frac{9}{2}$	12. $\frac{3}{8} \times \frac{16}{9}$
13. $\frac{39}{40} \times \frac{28}{26}$	14. $\frac{32}{9} \times \frac{16}{27}$	15. $\frac{12}{25} \times \frac{10}{21}$
16. $\frac{7}{12} \times \frac{40}{21}$	17. $\frac{9}{16} \times \frac{8}{27}$	18. $\frac{7}{15} \times \frac{25}{36}$
19. $\frac{44}{45} \times \frac{30}{22}$	20. $\frac{11}{15} \times \frac{45}{33}$	21. $\frac{15}{16} \times \frac{48}{25}$
22. $\frac{18}{25} \times \frac{20}{29}$	23. $\frac{14}{15} \times \frac{30}{49}$	24. $\frac{15}{16} \times \frac{64}{75}$
25. $\frac{32}{33} \times \frac{11}{64}$	26. $\frac{11}{14} \times \frac{21}{44}$	27. $\frac{45}{32} \times \frac{16}{15}$
28. $\frac{32}{45} \times \frac{15}{16}$	29. $\frac{100}{3} \times \frac{3}{200}$	30. $\frac{125}{2} \times \frac{3}{75}$
31. $\frac{9}{25} \times \frac{10}{33}$	32. $\frac{7}{75} \times \frac{150}{14}$	33. $\frac{1}{50} \times \frac{200}{3}$

Multiplying by a Mixed Number

73. 1. When the multiplier, or the multiplier and the multiplicand both are small mixed numbers, the product may be readily found; thus,

Multiply $2\frac{2}{5}$ by $3\frac{1}{4}$.

$$2\tfrac{2}{5} \times 3\tfrac{1}{4} = \frac{\overset{3}{\cancel{12}}}{5} \times \frac{13}{\cancel{4}} = \frac{39}{5} = 7\tfrac{4}{5}$$

2. When the multiplier is a large mixed number and the multiplicand an integer, the product may be readily found; thus,

Multiply 235 by $32\frac{2}{3}$.

$$\begin{array}{r} 235 \\ 32\frac{2}{3} \\ \hline 470 \\ 705 \\ 156\frac{2}{3} \\ \hline 7676\frac{2}{3} \end{array}$$

3. When the multiplier and multiplicand are both large mixed numbers, the product may be readily found; thus,

Multiply $127\frac{1}{4} \times 46\frac{2}{3}$

This shows the different steps:		*In practice write only this:*
$127\frac{1}{4}$		$127\frac{1}{4}$
$46\frac{2}{3}$		$46\frac{2}{3}$
762	$= 6 \times 127$	762
508	$= 40 \times 127$	508
$11\frac{1}{2}$	$= 46 \times \frac{1}{4}$	$11\frac{1}{2}$
$84\frac{2}{3}$	$= \frac{2}{3} \times 127$	$84\frac{2}{3}$
$\frac{1}{6}$	$= \frac{2}{3} \times \frac{1}{4}$	$\frac{1}{6}$
$5938\frac{1}{3}$	$= 46\frac{2}{3} \times 127\frac{1}{4}$	$5938\frac{1}{3}$

Exercise 58

1. $\frac{2}{3} \times 1\frac{1}{2}$	2. $\frac{3}{5} \times 2\frac{2}{3}$	3. $\frac{6}{7} \times 4\frac{1}{2}$
4. $\frac{3}{8} \times 1\frac{7}{9}$	5. $2\frac{3}{4} \times \frac{2}{9}$	6. $3\frac{3}{8} \times \frac{8}{4}$
7. $7\frac{1}{3} \times \frac{2}{9}$	8. $4\frac{1}{2} \times \frac{5}{6}$	9. $1\frac{1}{2} \times 1\frac{1}{3}$
10. $4\frac{1}{2} \times 3\frac{2}{3}$	11. $7\frac{1}{3} \times 2\frac{1}{2}$	12. $3\frac{1}{3} \times 3\frac{1}{2}$
13. $4\frac{3}{4} \times 5\frac{1}{7}$	14. $8\frac{2}{3} \times 7\frac{1}{2}$	15. $4\frac{3}{4} \times 2\frac{1}{4}$

16. $126 \times 16\frac{1}{2}$

17. $128 \times 23\frac{2}{3}$

18. $150 \times 32\frac{3}{4}$

19. $153 \times 34\frac{1}{4}$

20. $335 \times 24\frac{5}{6}$

21. $216 \times 52\frac{2}{5}$

22. $324 \times 45\frac{1}{2}$

23. $306 \times 9\frac{2}{3}$

24. $235 \times 32\frac{1}{3}$

25. $430 \times 4\frac{2}{3}$

26. $430 \times 47\frac{1}{4}$

27. $217 \times 18\frac{5}{6}$

28. $216\frac{1}{2} \times 19\frac{2}{3}$

29. $117\frac{2}{3} \times 26\frac{1}{2}$

30. $421\frac{3}{4} \times 14\frac{1}{6}$

31. $518\frac{1}{2} \times 32\frac{5}{6}$

32. $143\frac{1}{2} \times 25\frac{2}{3}$

33. $175\frac{3}{4} \times 16\frac{2}{3}$

34. $625\frac{1}{4} \times 37\frac{1}{5}$

35. $409\frac{1}{2} \times 48\frac{1}{2}$

36. $810\frac{3}{4} \times 36\frac{1}{2}$

37. $300\frac{1}{2} \times 52\frac{2}{3}$

38. $177\frac{1}{2} \times 44\frac{5}{6}$

39. $333\frac{4}{5} \times 35\frac{1}{2}$

Problems

Exercise 59

1. At $\frac{3}{4}$ ¢ a pound what will 16 lb. of old iron cost?

2. If it requires $1\frac{3}{4}$ yd. of cloth to make a waistcoat, how many yards are required for 6 waistcoats of the same pattern?

3. If a man walks at the rate of $\frac{3}{4}$ mi. an hour, how far will he walk in 8 hr.?

4. A boy that gained $\frac{1}{2}$¢ on each of 20 newspapers that he sold, gained how much on them all?

5. What was the cost of $2\frac{1}{2}$ doz. eggs at 20¢ a dozen?

6. What is the cost of 2 yd. of cloth at $12\frac{1}{2}$¢ a yard?

7. A man bought $\frac{1}{2}$ a bushel of seed, and sowed half of it; how much did he sow?

8. There are $5\frac{1}{2}$ yd. in a rod; how many yards are there in $\frac{1}{3}$ of a rod?

9. A man owned $\frac{1}{2}$ an acre of land and sold $\frac{3}{4}$ of it; how much did he sell?

10. What should $\frac{2}{3}$ of a yard of silk cost at $3 a yard?

11. $\frac{3}{4}$ of a foot is how many inches?

12. What will $\frac{3}{4}$ of a pound of dried beef cost at 32¢ a pound?

13. Find the cost of 8 lb. of coffee at $\$\frac{2}{5}$ a pound.

14. Eight $2\frac{1}{2}$-dollar gold pieces are worth how much?

15. Find the cost of $2\frac{1}{2}$ lb. of sugar at 8¢ a pound.

16. Find the cost of $\frac{3}{4}$ lb. of spices at 40¢ a pound.

17. Find the cost of $1\frac{1}{2}$ lb. of butter at 30¢ a pound.

18. Find the cost of $\frac{1}{2}$ lb. of tea at 60¢ a pound.

19. How much milk does a family use in a week if it uses $2\frac{1}{2}$ quarts in a day?

Exercise 60

1. When eggs are selling at 30¢ a dozen how much should be paid for $10\frac{1}{2}$ doz.?

2. $16\frac{1}{2}$ ft. make 1 rod; how many feet are there in 12 rods?

3. Find the selling price of a flock of 36 sheep at an average price of $\$ 5\frac{3}{4}$ a head.

4. Allowing each of 50 sailors $1\frac{3}{4}$ lb. of meat daily, how much meat must be supplied for a cruise of 10 days?

5. A barrel holding $42\frac{1}{2}$ gal. is $\frac{3}{4}$ full of sirup; how many gallons of sirup are there in the barrel?

6. What should be paid for $12\frac{1}{2}$ cords of wood at $\$ 1\frac{1}{2}$ a cord?

7. Find the weight of a bolt of dress flannel of 40 yd. if each yard weighs $\frac{5}{16}$ of a pound.

8. A dealer sold a plow for $\$ 6\frac{3}{4}$; if $\frac{1}{4}$ of this was gain, what was the cost?

9. If a farmer sows $2\frac{1}{2}$ bu. of wheat to the acre, how much does he sow on a field containing $12\frac{1}{2}$ A.?

10. On a certain map, $\frac{7}{12}$ of an inch is made to represent a mile; what length on the map would represent 25 miles?

11. Find the selling price of 20 overcoats that sold for $\$ 18\frac{1}{4}$ apiece.

12. A cubic foot of water weighs $62\frac{1}{2}$ pounds, and platinum is about 22 times as heavy as water; find the weight of a cubic foot of platinum.

13. There are $16\frac{1}{2}$ feet in a rod; how many feet long is a field whose length is $35\frac{1}{2}$ rods?

14. A barrel holding $31\frac{1}{2}$ gallons is $\frac{1}{4}$ full of vinegar; how many gallons of vinegar are there in the barrel?

DIVISION

Dividing a Fraction by a Whole Number

74. Here we see that:

$\frac{6}{8} \div 2 = \frac{3}{8} = \frac{6 \div 2}{8}$.

Also, $\frac{3}{4} \div 2 = \frac{3}{8} = \frac{3}{2 \times 4}$.

To divide a fraction by a whole number, divide the numerator or multiply the denominator.

NOTE.— Divide the numerator when possible.

Exercise 61

Name the answer at sight:

1. $\frac{2}{5} \div 2$	2. $\frac{3}{5} \div 2$	3. $\frac{2}{7} \div 2$
4. $\frac{4}{5} \div 2$	5. $\frac{1}{5} \div 2$	6. $\frac{1}{2} \div 3$
7. $\frac{3}{8} \div 3$	8. $\frac{4}{5} \div 3$	9. $\frac{4}{3} \div 2$
10. $\frac{4}{3} \div 3$	11. $\frac{1}{5} \div 3$	12. $\frac{6}{7} \div 3$
13. $\frac{5}{8} \div 2$	14. $\frac{4}{5} \div 5$	15. $\frac{3}{4} \div 5$
16. $\frac{1}{2} \div 5$	17. $\frac{1}{6} \div 5$	18. $\frac{5}{6} \div 5$
19. $\frac{4}{7} \div 3$	20. $\frac{4}{3} \div 6$	21. $\frac{2}{9} \div 3$
22. $\frac{4}{5} \div 4$	23. $\frac{3}{10} \div 5$	24. $\frac{5}{6} \div 4$
25. $\frac{3}{10} \div 2$	26. $\frac{3}{10} \div 4$	27. $\frac{7}{10} \div 5$
28. $\frac{3}{10} \div 8$	29. $\frac{9}{10} \div 3$	30. $\frac{9}{10} \div 10$
31. $\frac{7}{2} \div 2$	32. $\frac{8}{3} \div 2$	33. $\frac{12}{5} \div 12$
34. $\frac{5}{12} \div 12$	35. $\frac{7}{5} \div 10$	36. $\frac{11}{12} \div 3$
37. $\frac{12}{5} \div 6$	38. $\frac{1}{12} \div 6$	39. $\frac{4}{25} \div 3$

Exercise 62

1. If 2 yd. of cloth cost $\$\frac{4}{5}$, what does 1 yd. cost?

2. $\frac{5}{8}$ of an acre of land was divided into 5 lots of equal size; what part of an acre did each lot contain?

3. A boy who worked 2 hours for $\frac{1}{8}$ of a dollar earned what part of a dollar per hour?

4. If $\frac{1}{2}$ bu. of grass seed were sowed to 4 acres, what part of a bushel would be sowed to the acre?

5. A druggist put $\frac{1}{4}$ of a pint of oil into two bottles of equal size; what part of a pint did he put into each?

6. $\frac{3}{8}$ of a yard of lace was divided into 3 equal pieces; what part of a yard was there in each piece?

7. $\frac{3}{4}$ of an acre of land was divided into 6 lots of equal size; how much land did each lot contain?

8. A line $\frac{7}{8}$ of an inch long was divided into two equal parts; how long was each part?

9. If $\frac{3}{8}$ of a bushel of lime is used to whitewash both sides of a fence, how much should be used to whitewash one side of it?

10. If $\frac{1}{2}$ lb. of shot is divided into 8 equal loads, what part of a pound is there in each load?

11. A laborer cut $\frac{7}{4}$ acres of corn in 2 da.; how much was that per day?

12. If $\frac{1}{4}$ lb. of tea is used for 8 meals, the same quantity for each meal, how much is that for each meal?

Dividing by a Fractional Unit

75. Study these diagrams:

(1)

$1 \div \frac{1}{2} = 2$

That is, $\frac{1}{2}$ is contained *two* times in 1.

(2)

$1 \div \frac{1}{3} = 3$

That is, $\frac{1}{3}$ is contained *three* times in 1.

(3)

$1 \div \frac{1}{4} = 4$

That is, $\frac{1}{4}$ is contained *four* times in 1.

The quotient of 1 divided by a fractional unit is the denominator of the fractional unit.

Exercise 63

Name at sight the quotient:

1. $1 \div \frac{1}{5}$	2. $1 \div \frac{1}{6}$	3. $1 \div \frac{1}{8}$	4. $1 \div \frac{1}{10}$
5. $1 \div \frac{1}{12}$	6. $1 \div \frac{1}{16}$	7. $1 \div \frac{1}{15}$	8. $1 \div \frac{1}{14}$
9. $1 \div \frac{1}{32}$	10. $1 \div \frac{1}{7}$	11. $1 \div \frac{1}{9}$	12. $1 \div \frac{1}{50}$

76. Here we see that:

(1) $1 \div \frac{1}{2} = 2$.

(2) $2 \div \frac{1}{2} = 2 \times 2$.

Here we see that:

(1) $1 \div \frac{1}{3} = 3$.

(2) $2 \div \frac{1}{3} = 2 \times 3$.

Any whole number divided by a fractional unit is the denominator of the fractional unit multiplied by the whole number.

Exercise 64

Name at sight the quotient:

1. $3 \div \frac{1}{2}$	2. $4 \div \frac{1}{3}$	3. $5 \div \frac{1}{8}$	4. $6 \div \frac{1}{2}$
5. $3 \div \frac{1}{5}$	6. $2 \div \frac{1}{8}$	7. $8 \div \frac{1}{2}$	8. $4 \div \frac{1}{4}$
9. $2 \div \frac{1}{10}$	10. $5 \div \frac{1}{2}$	11. $6 \div \frac{1}{8}$	12. $4 \div \frac{1}{10}$
13. $8 \div \frac{1}{3}$	14. $4 \div \frac{1}{8}$	15. $8 \div \frac{1}{5}$	16. $5 \div \frac{1}{10}$

When the terms of a fraction are interchanged, the fraction is said to be **inverted.**

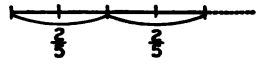
Thus, $\frac{5}{4}$ is $\frac{4}{5}$ inverted; that is, $\frac{5}{4}$ is the **inverse** of $\frac{4}{5}$.

A fraction and its inverse are called **reciprocals** of each other.

Thus, $\frac{4}{5}$ and $\frac{5}{4}$ are reciprocals.

Dividing 1 by a Fraction

77. This shows that 2 *times* $\frac{2}{5}$ and *half* of $\frac{2}{5}$ is found in 1.



That is, $1 \div \frac{2}{5} = 2\frac{1}{2}$, or $\frac{5}{2}$.

Notice that the *answer* $\frac{5}{2}$ is the *inverse* of $\frac{2}{5}$.

The quotient of 1 divided by a fraction is the inverse of the fraction.

Exercise 65

Name at sight the quotient:

1. $1 \div \frac{2}{3}$	2. $1 \div \frac{3}{4}$	3. $1 \div \frac{4}{5}$	4. $1 \div \frac{5}{6}$
5. $1 \div \frac{7}{8}$	6. $1 \div \frac{4}{3}$	7. $1 \div \frac{3}{2}$	8. $1 \div \frac{6}{5}$
9. $1 \div \frac{7}{12}$	10. $1 \div \frac{3}{8}$	11. $1 \div \frac{5}{12}$	12. $1 \div \frac{3}{16}$

13. $1 \div 1\frac{1}{2}$ SUGGESTION: $1 \div 1\frac{1}{2} = 1 \div \frac{3}{2}$.

14. $1 \div 2\frac{1}{2}$ 15. $1 \div 3\frac{1}{3}$ 16. $1 \div 4\frac{1}{2}$ 17. $1 \div 3\frac{1}{2}$

18. $1 \div 1\frac{2}{3}$ 19. $1 \div 1\frac{3}{4}$ 20. $1 \div 6\frac{2}{3}$ 21. $1 \div 8\frac{1}{3}$

Dividing any Whole Number by a Fraction

78. Here we see that:

$1 \div \frac{2}{5} = \frac{5}{2}$.

$2 \div \frac{2}{5} = \frac{5}{2} + \frac{5}{2}$, or $2 \times \frac{5}{2}$, or 5.

Notice that $2 \times \frac{5}{2}$ is found by multiplying the inverse of $\frac{2}{5}$ by 2.

To divide any whole number by a fraction, multiply the inverse of the fraction by the whole number.

Exercise 66

Name at sight the quotient:

1. $2 \div \frac{3}{4}$ 2. $3 \div \frac{2}{3}$ 3. $2 \div \frac{4}{5}$ 4. $3 \div \frac{5}{4}$

5. $2 \div \frac{3}{8}$ 6. $2 \div \frac{3}{5}$ 7. $2 \div \frac{3}{2}$ 8. $5 \div \frac{2}{3}$

9. $4 \div \frac{3}{4}$ 10. $5 \div \frac{3}{2}$ 11. $4 \div \frac{2}{3}$ 12. $2 \div \frac{3}{10}$

13. $2 \div 1\frac{1}{3}$ SUGGESTION. — $2 \div 1\frac{1}{3} = 2 \div \frac{4}{3}$.

14. $3 \div 1\frac{1}{2}$ 15. $3 \div 1\frac{2}{3}$ 16. $2 \div 1\frac{3}{4}$ 17. $2 \div 1\frac{3}{5}$

Dividing a Fraction or Any Number by a Fraction

79.

Since $1 \div \frac{3}{4} = \frac{4}{3}$,

and $2 \div \frac{3}{4} = 2 \times \frac{4}{3}$,

also $5 \div \frac{3}{4} = 5 \times \frac{4}{3}$.

Therefore, $\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3}$.

To divide a fraction by a fraction, multiply the dividend by the inverse of the divisor.

80. To divide any number by a fraction, multiply the number by the inverse of the fraction.

81. 1. Divide 4 by $\frac{3}{5}$.

$$4 \div \tfrac{3}{5} = \tfrac{5}{3} \times 4 = \tfrac{20}{3} = 6\tfrac{2}{3}.$$

2. Divide $\frac{4}{5}$ by $\frac{2}{3}$.

$$\tfrac{4}{5} \div \tfrac{2}{3} = \frac{3}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{5} = \frac{6}{5} = 1\tfrac{1}{5}.$$

3. Divide $3\frac{1}{3}$ by $2\frac{1}{2}$.

$$3\tfrac{1}{3} \div 2\tfrac{1}{2} = \frac{10}{3} \div \frac{5}{2} = \frac{\cancel{10}}{3} \times \frac{2}{\cancel{5}} = \frac{4}{3} = 1\tfrac{1}{3}.$$

Exercise 67

Find the quotients:

1. $\frac{2}{3} \div \frac{3}{4}$	2. $\frac{4}{5} \div \frac{3}{4}$	3. $\frac{6}{7} \div \frac{8}{9}$
4. $\frac{9}{10} \div \frac{3}{2}$	5. $\frac{15}{16} \div \frac{3}{4}$	6. $\frac{7}{8} \div \frac{9}{10}$
7. $\frac{9}{16} \div \frac{11}{12}$	8. $\frac{5}{9} \div \frac{25}{24}$	9. $2 \div \frac{2}{3}$
10. $3 \div \frac{4}{5}$	11. $7 \div \frac{3}{4}$	12. $5 \div \frac{5}{4}$
13. $4 \div 1\frac{1}{3}$	14. $9 \div 3\frac{1}{2}$	15. $8 \div 3\frac{2}{3}$
16. $4 \div 7\frac{1}{2}$	17. $1\frac{1}{2} \div 1\frac{1}{3}$	18. $3\frac{1}{3} \div 1\frac{3}{4}$
19. $2\frac{1}{2} \div 7\frac{1}{2}$	20. $3\frac{1}{3} \div 3\frac{1}{2}$	21. $1\frac{3}{4} \div 5\frac{1}{4}$
22. $1\frac{2}{3} \div 6\frac{2}{3}$	23. $12\frac{1}{2} \div 6\frac{1}{4}$	24. $2\frac{6}{7} \div 14\frac{2}{7}$
25. $3 \div 2\frac{2}{3}$	26. $4 \div 1\frac{1}{2}$	27. $10 \div 3\frac{1}{3}$

Dividing by Large Mixed Numbers

82. When the divisor is a large mixed number, the following is a desirable way of finding the quotient; thus,

Divide $233\frac{1}{3}$ by $12\frac{1}{2}$.

$12\frac{1}{2}$ $233\frac{1}{3}$

6 6

75)1400($18\frac{2}{3}$

75

650

600

$\frac{50}{75} = \frac{2}{3}$

Multiply both dividend and divisor by the l. c. d. of the fractions before dividing.

Exercise 68

Divide:

1. 100 by $14\frac{2}{7}$
2. $87\frac{1}{2}$ by $62\frac{1}{2}$
3. $133\frac{1}{3}$ by $66\frac{2}{3}$
4. $112\frac{1}{2}$ by $6\frac{1}{4}$
5. $187\frac{1}{2}$ by 25
6. $144\frac{4}{9}$ by $6\frac{2}{3}$
7. $262\frac{1}{2}$ by $18\frac{3}{4}$
8. $183\frac{1}{3}$ by $26\frac{2}{3}$
9. $237\frac{1}{2}$ by $33\frac{1}{3}$
10. $666\frac{2}{3}$ by $55\frac{5}{9}$

Problems

Exercise 69

1. At $6\frac{1}{4}¢$ a pound, how many pounds of sugar can be bought for $25¢$?

2. If the distance around a carriage wheel is $7\frac{1}{2}$ ft., how many times will it turn in going 150 ft.?

3. A cubic foot of water weighs $62\frac{1}{2}$ lb.; how many cubic feet of water are there in a ton of 2000 lb.?

4. How many times can a bucket, holding $4\frac{3}{4}$ gal., be filled from a barrel holding $47\frac{1}{2}$ gal.?

5. 20 bu. of grain are sowed on a field, $1\frac{1}{2}$ bu. to each acre; how many acres are there in the field?

6. How many cords $\frac{2}{3}$ of a foot long can be made from a piece $12\frac{2}{3}$ ft. long?

7. At $\$\frac{3}{4}$ each, how many yards of cloth can be bought for $\$12\frac{1}{2}$?

8. How many $\frac{3}{4}$ acre lots can be made from 15 acres of land?

9. If $\frac{3}{4}$ of an inch in a drawing represents a mile, what distance is represented by a line 3 inches long?

10. How many $\$2\frac{1}{2}$ gold pieces should be given in exchange for $\$62\frac{1}{2}$?

11. A barrel contains $31\frac{1}{2}$ gal. and a hogshead 63 gal. How many barrels are there in a hogshead?

12. At $\$\frac{1}{8}$ a yard, how many yards of cloth can be bought for $\$12$?

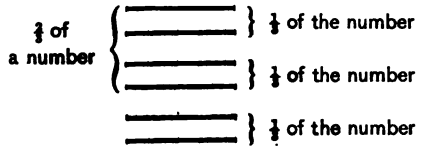
13. At $\$1\frac{1}{3}$ a yard, how many yards of silk can be bought for $\$18\frac{1}{2}$?

14. $5\frac{1}{2}$ yd. are called a rod; how many rods are there in a fence 110 yd. long?

15. How many bags are required to hold 100 bu. of seed if each bag holds $1\frac{1}{4}$ bu.?

FINDING THE WHOLE WHEN A FRACTIONAL PART IS GIVEN

83. 4 is $\frac{2}{3}$ of what number?



If $\frac{2}{3}$ of a number is 4, $\frac{1}{3}$ of the number is $\frac{1}{2}$ of 4, or ——, and $\frac{3}{3}$ of the number is 3 times ——, or ——.

Exercise 70

1. If $\frac{1}{2}$ of a number is 3, $\frac{2}{2}$ of a number is 2 times ——, or ——.

2. If $\frac{2}{3}$ of a number is 2, what is the number?

3. 9 is $\frac{3}{4}$ of what number?

4. 4 is $\frac{1}{2}$ of what number?

5. 10 is $\frac{5}{6}$ of what number?

6. 16 is $\frac{8}{9}$ of what number?

7. If $\frac{4}{5}$ of the length of a line is 8 inches, $\frac{1}{5}$ of its length is $\frac{1}{4}$ of —— inches, or —— inches, and $\frac{5}{5}$ of its length is —— times —— inches, or —— inches.

8. $\frac{5}{6}$ of the weight of a bushel of wheat is 50 pounds; what is the weight of a bushel of wheat?

9. A boy spelled correctly 20 words, which were $\frac{4}{5}$ of what he was given; how many was he given?

10. A farmer sold a cow for $32, which was $\frac{8}{9}$ of her cost; what was her cost?

COMPARISON

Exercise 71

1. What part of 4 is 1?

2. What part of 4 is 2?

3. What part of 4 is 3?

4. What part of 4 is 5?

5. What should be paid for 2 yards of cloth, if 4 yd. cost $8?

6. What should be paid for 3 days' labor if $10 was paid for 6 days' labor?

7. What part of 5 is $2\frac{1}{2}$?

8. What should be paid for 5 yd. of cloth, if $2\frac{1}{2}$ yd. cost $10?

9. If $1\frac{1}{2}$ lb. of poultry sold for 24¢, how much should be paid for 3 pounds?

10. What part of $\frac{1}{2}$ is $\frac{1}{4}$?

11. What should be paid for $\frac{1}{4}$ yd. of cloth if $\frac{1}{2}$ yd. costs 50¢?

12. What part of 3 is $1\frac{1}{2}$?

13. What should $1\frac{1}{2}$ lb. of sugar cost, if 3 lb. cost 24¢?

14. When oranges are bought at 20¢ a dozen, how much should be paid for 6 oranges?

15. If 2 inches on a map represent 5 miles, what do 8 inches on the map represent?

16. What should $\frac{1}{4}$ of a pound of spices cost if $\frac{1}{2}$ of a pound costs 30¢?

REVIEW OF FRACTIONS

Exercise 72

1. What is the distance around a square if each side of it is $\frac{3}{4}$ ft. long?

2. What is the distance around a room that is $18\frac{3}{4}$ ft. long and 16 ft. wide?

3. A cubic foot of water weighs $62\frac{1}{2}$ lb. and copper is about 9 times as heavy as water; what is the weight of a cubic foot of copper?

4. \$$22\frac{1}{2}$ was paid for three sheep, for each the same sum; what was paid for each?

5. What was the length of the iron rod used to make 10 bolts, each $5\frac{1}{4}$ in. long?

6. What was the cost of $12\frac{1}{2}$ doz. eggs at 32¢ a dozen?

7. At \$$\frac{4}{5}$ a yard, how many yards of cloth can be bought for \$5?

8. How many days will 10 bu. of oats last a horse which eats $\frac{3}{8}$ of a bushel per day?

9. The sum of three numbers is 100. If one of them is $22\frac{2}{9}$ and another is $33\frac{1}{3}$, what is the third number?

10. If $2\frac{1}{2}$ in. on a map represent 10 miles, what is the distance between two places on this map if their real distance apart is 40 miles?

11. Write in words $\frac{8}{9}$.

12. If $\frac{2}{3}$ of a number is 42, what is the number?

13. If $1\frac{1}{2}$ times a number is 36, what is the number?

14. If 5 times a number is $37\frac{1}{2}$, what is the number?

15. A merchant asked \$15 for an article, but sold it at $\frac{1}{4}$ of this price; for what did he sell it?

16. A merchant sold an article at $\$12\frac{1}{2}$, which was $\$2\frac{1}{4}$ less than he paid for it; how much did he pay for it?

17. What is the cost of $2\frac{1}{4}$ acres of land at \$75 an acre?

18. If $\frac{3}{4}$ of a bushel of seed cost \$6, how much was that per bushel?

19. What number must be added to 25 to make $37\frac{1}{2}$?

20. Find the cost of cleaning 20 yd. of carpet at $2\frac{1}{2}¢$ per yard.

21. Find the cost of thrashing 60 bu. of oats at $2\frac{1}{2}¢$ a bushel.

22. What should a mechanic be paid for $\frac{3}{4}$ of a day's work at $\$3\frac{1}{2}$ a day?

23. A laborer who is paid \$1.60 for working ten hours a day, should be paid how much for six hours of work?

24. When a machinist is earning $\$\frac{3}{8}$ an hour, how much is he earning each working day of 10 hours?

25. Find the cost of a ham weighing $12\frac{3}{4}$ lb. at $16¢$ a pound.

26. When $\frac{1}{4}$ bu. of potatoes sells for \$0.30, how much is that a bushel?

27. If a $4\frac{1}{2}$-lb. dressed chicken costs 63¢, how much is that a pound?

28. $5\frac{1}{2}$ gal. of sirup will fill how many bottles, each holding $\frac{1}{8}$ of a gallon?

29. If a woman was charged $\$10\frac{1}{2}$ for a week's board, how much was that a day?

30. A piece of cloth shrunk $\frac{1}{10}$ of its length when sponged; it then measured 9 yd. How long was it before shrinking?

31. What should be paid for 8 days' work if $\$4\frac{4}{5}$ was paid for 4 days' work?

32. $\frac{4}{5}+\frac{7}{10}+\frac{8}{5}-\frac{1}{2}=?$

33. If $\frac{1}{2}$ an acre of wheat yields $18\frac{3}{4}$ bu., what is the yield per acre?

34. Two pieces each $10\frac{1}{4}$ ft. long were cut from a log 30 ft. long; what was the length of the piece that remained?

35. How many strips of carpet, each $\frac{3}{4}$ of a yard wide, are needed to cover a floor 18 ft. wide?

36. How many strips of wall paper $2\frac{1}{4}$ ft. wide are required to cover a ceiling 27 ft. wide?

37. How many pounds of copper can be bought for $\$6$ at $\$\frac{3}{4}$ a pound?

38. If a man takes, on an average, 110 steps per minute, each step $2\frac{1}{2}$ ft. long, how many feet does he walk per hour?

39. If $\frac{5}{6}$ of a number is $12\frac{1}{2}$, what is the number?

40. A owed B $\$12\frac{1}{2}$ and has paid him $\frac{4}{5}$ of this sum; how much does he still owe B?

41. A $\$2\frac{1}{2}$ hat, a $\$2\frac{3}{4}$ waistcoat and a $\$3\frac{1}{4}$ pair of shoes together cost how much?

42. What do $21\frac{3}{4}$ yd. of cloth cost at $\$3\frac{3}{5}$ a yard?

43. How many packages of seed, each containing $\frac{1}{8}$ of a pound, can be made from a bushel of seed weighing 60 lb.?

44. A man sold a harness for $\$18\frac{1}{2}$, which was at a loss of $\$1\frac{3}{4}$; what did he pay for it?

45. How many $3\frac{1}{2}$-ft. boards can be sawed from a board 24 ft. long? What length will there be left over?

46. A piece of iron 8 inches long was cut into bolts $\frac{3}{4}$ of an inch long; how many bolts did it make and what was the length of the piece left over?

47. A owns $12\frac{1}{2}$ acres of land and B owns $6\frac{1}{4}$ acres more than A; how much do they both own?

48. In a mixture of 50 bushels of corn, oats, and rye there are $16\frac{1}{2}$ bushels of corn and 12 bushels of rye; how much oats is there?

49. If a lamp consumes a gallon of oil in 20 hours, what part of a gallon will it consume in 1 hour? in 5 hours?

50. How many $\frac{1}{8}$-acre plats of land can be made from $2\frac{1}{4}$ acres?

51. What average does a girl receive in four studies if she receives a mark of 80 in one, $82\frac{1}{2}$ in another, $83\frac{3}{4}$ in another, and $87\frac{1}{2}$ in another?

52. If A can do $\frac{3}{16}$ of a piece of work in a day, and B can do $\frac{1}{8}$ of it in a day, what part of the work can both do in one day? What part can they do in 2 days?

53. A rod is $5\frac{1}{2}$ yards; how many rods are there in 1100 yd.?

54. A turkey that lost $\frac{1}{10}$ of its weight in dressing, weighed $13\frac{1}{2}$ lb. when dressed; what was its live weight?

55. If $\frac{1}{2}$ a yard of silk costs 60¢; what will $\frac{1}{4}$ a yard cost at the same price per yard?

56. If $\frac{3}{4}$ of a number is 12, what is 2 times the number?

57. A man bought a bill of groceries amounting to $\$12\frac{1}{2}$; he paid $\frac{4}{5}$ of this in cash and had the remainder charged. How much did he have charged?

58. A dealer lost $2\frac{1}{2}$¢ a yard by selling a piece of cloth containing 6 yd. for $12\frac{1}{2}$¢ per yard; what did the 6 yd. cost him?

59. A quart of milk weighs about $2\frac{1}{2}$ lb.; how many quarts of milk will weigh 2000 lb.?

60. If a laborer was paid \$2 for $1\frac{1}{4}$ days' work, what should he be paid for $2\frac{1}{2}$ days' work?

GENERAL REVIEW

Exercise 73

1. In the following table, read the distances between each city and each city named above it.

DISTANCES BETWEEN EUROPEAN CITIES

TRAVELING DISTANCES BETWEEN THE PRINCIPAL CITIES IN EUROPE, IN MILES

																		London
																	Liverpool	202
																Paris	489	287
															Madrid	908	1397	1195
														Lisbon	415	1323	1812	1610
													Antwerp	1530	1119	211	472	270
												Hamburg	412	1804	1495	587	859	657
											Berlin	178	497	1889	1582	674	948	746
										Berne	611	678	460	1602	1183	359	848	646
									Turin	297	887	839	719	1506	1073	500	989	787
								Vienna	720	585	427	605	727	2157	1668	849	1182	980
							Munich	266	470	295	401	579	522	1897	1477	582	970	768
						Rome	647	840	414	639	1048	1180	1033	1746	1223	907	1397	1195
					Trieste	510	487	370	391	533	888	1066	1009	1828	1416	863	1352	1150
				Warsaw	806	1276	702	436	1156	1021	398	576	895	2593	1925	1067	1557	1355
			Constantinople	1205	1725	2138	1564	1298	2018	1883	1699	1903	2025	3345	2718	1899	2232	2030
			Odessa	363	842	1330	1800	1226	960	1680	1545	1240	1418	1737	3117	2625	1760	2119	1917
		Moscow	950	1339	811	1617	2087	1518	1247	1967	1832	1209	1387	1706	3414	2904	1843	2117	1915
	St. Petersburg	406	1356	1733	693	1769	2239	1395	399	2119	1714	1091	1269	1588	3286	2874	1699	1976	1774
	Stockholm	430	836	1510	2408	1082	1171	1731	1084	1110	1337	1176	685	580	993	2384	1972	1219	1491	1289
Copenhagen	416	846	1252	1510	1510	668	1067	1318	671	697	1047	885	270	208	620	2012	1600	812	1181	979

2. A man sold 2 houses for $4000 each; on one he gained $750, and on the other he lost $250. What did the houses cost him and what was his gain?

3. The sum of three numbers is 500; two of them are 175 and 87. What is the third?

4. A builder made a contract to construct a piece of road for $10,200; he spent $7567.50 in the construction. What was his profit?

5. A dealer sold a horse for $225, which was $75 more than he paid for it; what did he pay for it?

6. A farmer owed a debt of $750; if he paid $275 at one time and $125 at another, what did he then owe?

7. A motorman that makes three trips per hour from 6 A. M. till noon, travels how many miles if each trip is 2 miles long?

8. Find the missing numbers by multiplying across and adding upward:

$28 \times 284 = \bullet$	$76 \times 317 = \bullet$	$89 \times 123 = \bullet$
$28 \times 175 = \bullet$	$76 \times 498 = \bullet$	$89 \times 187 = \bullet$
$28 \times 396 = \bullet$	$76 \times 293 = \bullet$	$89 \times 236 = \bullet$
$28 \times 987 = \bullet$	$76 \times 673 = \bullet$	$89 \times 189 = \bullet$
$28 \times ? = \bullet$	$76 \times ? = \bullet$	$89 \times ? = \bullet$

9. A clerk earning $60 each month spends $42 a month; he has already saved $2400. How many more months must he save at the same rate to have sufficient to pay for a $6000 house?

10. At 25¢ per dozen, how many dozen eggs can be bought for $6.25?

11. A contractor built a row of houses on which he gained $6048; this was an average gain of $216 on a house. How many houses were there in the row?

12. If 36 bushels of potatoes were raised on $\frac{3}{4}$ of an acre, how many bushels at the same rate could be raised on an acre?

13. For how many days' board am I charged, if my bill is $37\frac{1}{2}$, at the rate of $2\frac{1}{2}$ per day?

14. A man bought 60 bushels of potatoes at $\$\frac{3}{4}$ per bushel and sold them for $50; did he gain or lose, and how much?

15. A laborer worked $3\frac{1}{2}$ days one week, and $5\frac{3}{4}$ days the next week, and $4\frac{3}{4}$ days the following week; how many days was he idle in the three weeks?

16. If 4 yd. of ribbon cost $8\frac{1}{3}¢$, how much should 24 yd. cost?

17. I cut 5 pieces of carpet, each $2\frac{3}{4}$ yd. long, from a piece containing 20 yd., how much have I left?

18. A man sold 15 acres of land, which was $\frac{3}{4}$ of what he owned; how much had he left?

19. Find the cost of $3\frac{1}{2}$ yd. of ribbon at $12\frac{1}{2}¢$ a yd.

20. Find the cost of 42 oranges at $40¢$ a dozen.

21. Find the cost of 30 bananas at $12\frac{1}{2}¢$ a dozen.

22. A man owned 7 acres of land and sold 5 acres of it for $5225; what is the remainder worth at the same price per acre?

23. At the rate of $2\frac{1}{4}$ a yard, how many yards of carpet can be bought for $36?

24. On an article costing $5\frac{1}{3}$ there was a loss in selling of $\frac{3}{8}$ of the cost. Find the selling price.

25. Allowing each of 15 sailors $1\frac{3}{4}$ lb. of meat daily, how much meat must be supplied for a cruise of 31 days?

26. If $2\frac{1}{2}$ inches on a map represent 10 miles, what is the distance between 2 places on this map if the real distance is $37\frac{1}{2}$ miles?

27. If a 10-foot pole casts a shadow $12\frac{1}{2}$ feet long, what is the length of the flagpole that casts a shadow $87\frac{1}{2}$ feet long at the same time?

28. A gained \$50 by selling his horse for \$300; what part of the cost was the gain?

29. How many jars, each holding $\frac{3}{8}$ of a pint, can be filled with $7\frac{1}{8}$ pints of maple sirup?

30. How much money must a contractor draw from a bank to pay a force of 20 men for the six working days of a week, each man getting $\$1\frac{3}{4}$ per day?

31. Find the amount of my bill if I buy:

$5\frac{1}{4}$ yd. of ribbon @ 10¢.
$6\frac{1}{2}$ yd. of lace @ 15¢.
$2\frac{3}{4}$ yd. of silk @ 96¢.
$4\frac{1}{2}$ lb. of sugar @ $6\frac{1}{2}$¢.
$2\frac{1}{2}$ lb. of lard @ $12\frac{1}{2}$¢.

32. A mechanic was employed for \$65 a month, and paid $\$37\frac{1}{2}$ a month for board and other expenses; how much did he save in 9 months?

33. Simplify:

$$\tfrac{1}{2}+\tfrac{1}{4}+\tfrac{1}{2} \text{ of } \tfrac{1}{4}-\tfrac{1}{6}+\tfrac{1}{3}.$$

34. The weight of a common brick is about $4\frac{1}{2}$ pounds; what is the weight of a load of 500 bricks?

DECIMALS

INTRODUCTORY EXERCISES AND DEFINITIONS

1. Beginning at the left, tell for what piece of money each 1 in $1.11 stands.

2. 1 dime is what part of a dollar?

3. 1 cent is what part of a dime?

4. Each 1 in $1.11 expresses what part of the value of the 1 next to it on the left?

5. Tell for what each 1 in 1.11 stands.

Just as each 1 in 1.11 stands for $\frac{1}{10}$ of the value of the 1 next to it on the left, so the last 1 to the right in 1.111 is $\frac{1}{10}$ of $\frac{1}{100}$, or $\frac{1}{1000}$.

84. If anything is divided into 10, 100, or 1000 equal parts, these parts are called **decimal parts.**

85. Any number of decimal parts of a unit is a **decimal fraction,** or simply a **decimal.**

86. Decimal fractions may be written without a denominator. A figure written in the first place to the right of the decimal point expresses *tenths;* in the second place, *hundredths;* in the third place, *thousandths.*

Thus, .7 expresses *seven tenths,*
.07 expresses *seven hundredths,*
and, .007 expresses *seven thousandths.*

READING AND WRITING DECIMALS OF ONE ORDER

Exercise 74

Read:

1. .1; .03; .04
2. .5; .008; .007
3. .08; .001; .6
4. .006; .4; .05
5. .7; .01; .003
6. .09; .002; .3
7. .004; .9; .06
8. .2; .02; .005

Exercise 75

Write in words:

1. .5; .04; .009
2. .8; .07; .006
3. .004; .6; .03
4. .08; .002; .7
5. .01; .005; .4
6. .9; .06; .008

Write as decimals:

7. $\frac{2}{10}$
8. $\frac{5}{100}$
9. $\frac{7}{1000}$
10. $\frac{9}{1000}$
11. $\frac{9}{10}$
12. $\frac{1}{10}$
13. $\frac{1}{100}$
14. $\frac{1}{1000}$
15. $\frac{7}{10}$
16. $\frac{4}{10}$
17. $\frac{4}{100}$
18. $\frac{4}{1000}$

READING AND WRITING DECIMALS OF MORE THAN ONE ORDER

87. $.275 = \frac{2}{10} + \frac{7}{100} + \frac{5}{1000} = \frac{200}{1000} + \frac{70}{1000} + \frac{5}{1000} = \frac{275}{1000}$ = 275 thousandths.

To read a decimal, read the number expressed by the figures of the decimal and pronounce the name of the place occupied by the right-hand figure.

Exercise 76

Read:

1. .025 Thus, *twenty-five thousandths.*
2. 7.32 Thus, *seven and thirty-two hundredths.*

3. .25	4. .201	5. .42	6. .572
7. .304	8. .27	9. .750	10. .820
11. .09	12. .74	13. .047	14. .274
15. 4.07	16. 8.47	17. 5.704	18. 6.549
19. 7.4	20. 3.742	21. 2.523	22. 9.248

Exercise 77

Write in decimal form:

1. $\frac{25}{100}$	2. $\frac{75}{100}$	3. $\frac{80}{100}$	4. $\frac{50}{100}$
5. $\frac{45}{100}$	6. $\frac{25}{1000}$	7. $\frac{50}{1000}$	8. $\frac{375}{1000}$
9. $\frac{205}{1000}$	10. $\frac{210}{1000}$	11. $\frac{500}{1000}$	12. $\frac{675}{1000}$

13. 24 hundredths. SUGGESTION. — Write 24 and so place the decimal point that 4 stands in *hundredths'* place; thus, .24.

14. 15 tenths. SUGGESTION. — Write 15 and so place the decimal point that 5 stands in *tenths'* place; thus, 1.5.

15. 12 hundredths	16. 25 thousandths
17. 16 thousandths	18. 30 thousandths
19. 15 hundredths	20. 50 hundredths
21. 22 hundredths	22. 12 tenths
23. 67 hundredths	24. 132 thousandths

25. 206 thousandths
26. 212 hundredths
27. 404 hundredths
28. 607 thousandths
29. 25 tenths
30. 40 thousandths
31. 86 hundredths
32. 164 thousandths
33. 107 thousandths
34. 145 hundredths

REDUCTION

Reducing Decimals to Different Denominations

88. 1. When both terms of $\frac{6}{10}$ are multiplied by 10, what is the result?

2. Does $\frac{6}{10}$ equal $\frac{60}{100}$? Why?

3. When both terms of $\frac{6}{10}$ are multiplied by 100, what is the result?

4. Does $\frac{6}{10}$ equal $\frac{600}{1000}$? Why?

5. By what must both terms of $\frac{60}{100}$ be divided in order that the result may be $\frac{6}{10}$?

6. Does dividing both terms of $\frac{60}{100}$ by 10 change the value of the fraction? Why?

7. Does $\frac{600}{1000}$ equal $\frac{6}{10}$? Why?

$$\frac{6}{10} = \frac{60}{100} = \frac{600}{1000}.$$

That is, $.6 = .60 = .600$.

89. 1. **Annexing ciphers to a decimal does not change its value.**

2 **Removing ciphers from the right of a decimal does not change its value.**

Exercise 78

Reduce:

1. .5 to hundredths
2. .08 to thousandths
3. .200 to tenths
4. .420 to hundredths
5. .85 to thousandths
6. .300 to hundredths
7. .90 to tenths
8. .04 to thousandths
9. .240 to hundredths
10. .30 to tenths
11. .37 to thousandths
12. .7 to hundredths
13. .6 to thousandths
14. .05 to thousandths
15. .400 to tenths
16. .800 to hundredths
17. .55 to thousandths
18. .600 to tenths

Reducing Decimals to Common Fractions or Mixed Numbers

Exercise 79

Reduce to common fractions or mixed numbers:

1. .375 Thus, $.375 = \frac{375}{1000} = \frac{3}{8}$.
2. .8
3. .75
4. 7.6
5. .4
6. .04
7. 3.75
8. .25
9. .625
10. .875
11. .6
12. .50
13. 1.125
14. .225
15. 7.75
16. 8.50
17. 7.45
18. 9.60
19. 10.45

Reducing Common Fractions or Mixed Numbers to Decimals

90. A common fraction that can easily be reduced to tenths, hundredths, or thousandths may readily be reduced to a decimal; thus:

1. $\frac{3}{5} = \frac{6}{10} = .6$
2. $\frac{3}{4} = \frac{75}{100} = .75$
3. $\frac{3}{8} = \frac{375}{1000} = .375$
4. $\frac{17}{500} = \frac{34}{1000} = .034$

Exercise 80

Reduce to decimals:

1. $\frac{1}{2}$	2. $\frac{4}{5}$	3. $\frac{3}{50}$	4. $\frac{2}{25}$
5. $\frac{1}{4}$	6. $\frac{7}{50}$	7. $\frac{9}{25}$	8. $\frac{15}{50}$
9. $\frac{5}{8}$	10. $\frac{9}{200}$	11. $\frac{7}{8}$	12. $\frac{7}{500}$
13. $\frac{17}{20}$	14. $\frac{11}{25}$	15. $2\frac{9}{10}$	16. $8\frac{1}{2}$
17. $5\frac{4}{5}$	18. $7\frac{3}{25}$	19. $8\frac{3}{50}$	20. $10\frac{1}{5}$

ADDITION

91. Find the sum of 2.5, 13.75, .018, and 12.56.

$$\begin{array}{r} 2.5 \\ 13.75 \\ .018 \\ 12.56 \\ \hline 28.828 \end{array}$$

Write the numbers so that units of the same order stand in the same column, and add as in addition of whole numbers. Place the decimal point between units and tenths in the sum.

Exercise 81

Find the sum of:

1.	2.	3.
6.14	1.004	.403
.186	.31	4.25
31.4	25.06	.117
.561	.9	12.075

4. .6, .074, and .73.

5. 2.19, 7.005, and 15.3.

6. .45, 3.77, .017, and .711.

7. 30.03, 114.250, .09, and .02.

8. 7 tenths, 52 hundredths, and 19 thousandths.

9. 3 and 1 tenth, 21 thousandths, and 3 and 8 hundredths.

10. 4 tenths, 78 hundredths, and 220 thousandths.

11. 13 and 21 thousandths, 6 and 6 hundredths, and 8 tenths.

SUBTRACTION

92. 1. From 12.75 take 7.9. 2. From 28.7 take 1.245.

12.75	28.700
7.9	1.245
4.85	27.455

Write the numbers so that units of the same order stand in the same column, and subtract as in subtraction of whole numbers. Place the decimal point between units and tenths in the difference.

Exercise 82

Subtract:

1.	2.	3.	4.
5.632	4.000	7.4	8.
1.16	2.341	3.100	4.237

5.	6.	7.	8.
2.40	6.10	52.1	32.07
1.10	.57	2.04	13.005

Find the difference:

9. $3 - .431$
10. $3 - .011$
11. $6.101 - .122$
12. $8.52 - .006$
13. $8.13 - .021$
14. $25.2 - .112$

Find the difference between:

15. 72 hundredths and 57 thousandths.
16. 3 and 4 tenths and 55 hundredths.
17. 73 hundredths and 21 thousandths.
18. 9 and 8 tenths and 36 hundredths.

Problems

Exercise 83

1. A merchant had \$172.40 cash on hand at the beginning of a day. During the day he received \$264.18 and paid out \$ 86.12. What was his cash balance at the close of the day?

2. A dealer bought a horse for $175.75, paid $2.50 for his feed, and then sold him for $190. Find his gain.

3. A man's store bill for January was $ 30.42, for February $ 28.95, for March $ 29.16, for April $ 36.12, for May $ 34.08, and for June $ 30.60; what was his store bill for the six months?

4. Read, supplying the missing numbers:

(*a*) $1+.3=\bullet$ (*c*) $1+.06=\bullet$

(*b*) $1-.4=\bullet$ (*d*) $1-.05=\bullet$

5. Find the cost of the following bill of hardware:

1 stove	$30.50
1 saw	2.25
1 pail	.25
1 pound of nails	.08
1 file	.09
Total	

6. At a certain point a river rose to within 3.7 feet of the high-water mark, which was 12.1 feet above low-water mark; how high above low-water mark was the river at that time?

7. Take the sum of 5 tenths and 5 hundredths from 6 and 6 tenths.

8. What was the average cost of 3 sheep if one of them cost $5.25, another $4.25, and another $5.50?

9. Find the amount of John Hollinger's deposit Sept. 3 as shown by the following:

FARMERS AND MECHANICS TRUST COMPANY

JOLIET, ILL., SEPT. 3, 1914.

DEPOSIT OF

JOHN HOLLINGER

	DOLLARS	CENTS
Notes — fives, etc.	65	
Ones and Twos	24	
Fractional	2	64
Checks	21	40
(Enter Singly)		

10. The distance around a room 22.25 feet long is 80.5 feet. How wide is the room?

MULTIPLICATION

Multiplying a Decimal by an Integer

93. 1. $3 \times .5 = 3 \times \frac{5}{10}$, or $\frac{15}{10}$, or 1.5.

2. $5 \times .15 = 5 \times \frac{15}{100}$, or $\frac{75}{100}$, or .75.

In Examples 1 and 2 compare the number of decimal places in the multiplicand with the number in the product.

To multiply a decimal by an integer, multiply as in whole numbers and point off as many decimal places in the product as there are in the multiplicand.

Multiply .065 by 35; .065 by 420.

In practice find the products thus:

.065	.065
35	420
325	1 300
1 95	26 0
2.275	27.300

Exercise 84

Multiply:

1. .22	2. 4.12	3. 1.28
4	32	40
4. .117	5. 1.627	6. .047
25	213	320

7. .22 by 3
8. .56 by 4
9. .421 by 4
10. 2.13 by 9
11. .63 by 7
12. .117 by 3
13. 4.606 by 13
14. 1.145 by 22
15. 21.16 by 25
16. .173 by 54
17. 8.60 by 32
18. 3.124 by 33
19. 9.20 by 123
20. .16 by 321
21. .313 by 620
22. 2.175 by 108
23. 1.220 by 116
24. .104 by 320
25. 14.56 by 200
26. .785 by 140

Multiplying Decimals by 10, 100, and 1000

94. 1. $10 \times .005 = 10 \times \frac{5}{1000} = \frac{5}{100}$, or .05

2. $100 \times .005 = 100 \times \frac{5}{1000} = \frac{5}{10}$, or .5

3. $1000 \times .005 = 1000 \times \frac{5}{1000}$, or 5

In 1, 2, and 3 observe the position of the decimal point in the multiplicand and in the product.

Moving the decimal point one place to the right multiplies by 10, moving it two places to the right multiplies by 100, moving it three places to the right multiplies by 1000.

Exercise 85

Read, supplying at sight the missing products:

1. $10 \times .2$	2. $10 \times .9$
3. $10 \times .04$	4. $10 \times .08$
5. 10×2.5	6. $10 \times .25$
7. 10×12.5	8. $10 \times .007$
9. $10 \times .075$	10. 10×7.75
11. $100 \times .02$	12. $100 \times .12$
13. 100×1.5	14. 100×3.05
15. 100×5.75	16. $100 \times .075$
17. $100 \times .005$	18. 100×5.50
19. $1000 \times .002$	20. $1000 \times .075$
21. $1000 \times .375$	22. 1000×2.075
23. 1000×2.50	24. $1000 \times .75$

DIVISION

Dividing a Decimal by an Integer

95. 1. $.6 \div 3 = \frac{6}{10} \div 3 = \frac{2}{10}$, or .2

2. $.06 \div 3 = \frac{6}{100} \div 3 = \frac{2}{100}$, or .02

3. $.12 \div 3 = \frac{12}{100} \div 3 = \frac{4}{100}$, or .04

4. $.015 \div 3 = \frac{15}{1000} \div 3 = \frac{5}{1000}$, or .005

In Exercises 1, 2, 3, and 4 compare the number of decimal places in the quotient with the number in the dividend.

To divide a decimal by an integer, divide as in whole numbers and point off as many decimal places in the quotient as there are in the dividend.

96. Divide .025 by 5; 8.25 by 25; .4 by 25.

In practice find the quotients thus:

5).025	.33	.016
.005	25)8.25	25).400
	75	25
	75	150
	75	150

Exercise 86

Divide:

1. .005 by 5	2. 3.6 by 9	3. .63 by 7
4. .72 by 8	5. .024 by 6	6. .012 by 6
7. 9.18 by 9	8. .2 by 5	9. .04 by 8
10. .003 by 6	11. .012 by 12	12. 7.014 by 7
13. 31.5 by 35	14. 6.25 by 25	15. .225 by 15

16. 3.5 by 14 17. .256 by 16 18. 5.4 by 45
19. 2.52 by 42 20. 1.5 by 25 21. .27 by 18
22. 5.32 by 38 23. .875 by 35 24. 1.512 by 42

Dividing Decimals by 10, 100, and 1000

97. 1. $.04 \div 10 = \frac{4}{100} \div 10 = \frac{4}{1000}$, or .004

2. $.4 \div 100 = \frac{4}{10} \div 100 = \frac{4}{1000}$, or .004

3. $4 \div 1000 = \frac{4}{1000}$, or .004

In 1, 2, and 3 observe the position of the decimal points in the dividend and in the quotient.

Moving the decimal point one place to the left divides by 10, moving it two places to the left divides by 100, moving it three places to the left divides by 1000.

Exercise 87

Read, supplying at sight the missing quotients:

1. $5 \div 10$ Thus, $5 \div 10 = .5$
2. $25 \div 100$ Thus, $25 \div 100 = .25$
3. $36 \div 1000$ Thus, $36 \div 1000 = .036$
4. $6 \div 10$
5. $50 \div 10$
6. $15 \div 10$
7. $.3 \div 10$
8. $.5 \div 10$
9. $2.5 \div 10$
10. $1.2 \div 10$
11. $.02 \div 10$
12. $.75 \div 10$
13. $.82 \div 10$
14. $.07 \div 10$
15. $.32 \div 10$
16. $7 \div 100$
17. $1 \div 100$

18. $25 \div 100$	19. $36 \div 100$
20. $3.5 \div 100$	21. $5.5 \div 100$
22. $20 \div 100$	23. $7 \div 1000$
24. $80 \div 1000$	25. $900 \div 1000$

Dividing by an Integer Ending in One or More 0's

98. 1. Divide 6.3 by 30.

$3\emptyset\overline{)6.3}$ Divide by 30 by dividing by 10 (how?) and
$.21$ then by 3.

2. Divide 32.5 by 500.

$5\emptyset\emptyset\overline{)32.5}$ Divide by 500 by dividing by 100 (how?)
$.065$ and then by 5.

Exercise 88

Divide:

1. 2.6 by 20	2. 8 by 40
3. 1.2 by 60	4. .15 by 30
5. .06 by 30	6. 42 by 60
7. 4.8 by 80	8. 3 by 60
9. .45 by 90	10. 4.5 by 50
11. 27.6 by 30	12. 2.79 by 90
13. 28 by 200	14. 360 by 300
15. 4.8 by 200	16. 72 by 600
17. 22.5 by 150	18. 6.25 by 250
19. 14.4 by 120	20. 720 by 3000
21. 1250 by 5000	22. 75 by 150
23. 1250 by 2500	24. 3750 by 5000

MULTIPLICATION AND DIVISION

Exercise 89

1. A merchant failed in business and could pay only $0.625 on each dollar he owed. How much did he pay if his debts were $5000?

2. Find the weight of 9 hams if the average weight is 15.75 lb.

3. What was the yield of 20 acres of wheat averaging 18.75 bu. per acre?

4. A cubic foot of water weighs 62.5 lb.; what is the weight of the water in a tank containing 20 cubic feet?

5. If I divide $2.25 equally among 9 boys, how much will each boy get?

6. If a man walked 14 miles in 4 hr., how many miles was that an hour?

7. A farmer sold 10 bushels of wheat which weighed 585 lb.; what was the weight per bushel?

8. If 5 yd. of silk cost $6.25, how much is that a yard?

Find the cost of:

9. 10 yd. of cloth at $0.125 per yard.

10. 10 fruit trees at $0.25 each.

11. 10 rakes at $0.45 each.

12. 10 yd. of carpet at $1.25 per yard.

13. 100 lb. of iron at $0.125 per pound.
14. 300 rails at $6.50 per C.
15. 250 shad at $30 per C.
16. 2000 gun wads at $0.48 per M.
17. 360 paper bags at $0.08 per C.
18. 2500 envelopes at $2.25 per C.
19. 600 posts at $18 per C.
20. 200 bolts at $0.49 per C.
21. 2000 paper fasteners at $0.35 per C.
22. 2600 balls of string at $35 per M.

UNITED STATES MONEY

99. The standard unit of value in the United States is the **dollar.**

Table

10 mills (m.)	**= 1 cent (ct.)**
10 cents	**= 1 dime (d.)**
10 dimes	**= 1 dollar ($)**
10 dollars	**= 1 eagle (E.)**

Since a dime equals $\frac{1}{10}$ of a dollar, a cent $\frac{1}{100}$ of a dollar, and a mill $\frac{1}{1000}$ of a dollar, any sum may be expressed in dollars without reduction by placing the number of dimes in the tenths' place, the number of cents in the hundredths' place, and the number of mills in the thousandths' place.

Thus, 25 dollars 4 dimes 6 cents 5 mills may be expressed $25.465, and read *25.465 dollars,* or *25 dollars 46 cents 5 mills.*

Exercise 90

1. How many mills are there in 2¢? 5¢? 7¢? 1 d.?
2. How many cents are there in 3 d.? 5 d.? $\frac{1}{2}$ d.?
3. How many mills are there in $\frac{1}{2}$¢? in $2\frac{1}{2}$¢? in $1\frac{1}{2}$¢?
4. How many cents are there in \$2? \$4? \$10?
5. How many cents are there in $\$\frac{1}{2}$? $\$\frac{1}{4}$? $\$\frac{3}{4}$? $\$\frac{1}{8}$?
6. How many cents are there in $\$\frac{3}{8}$? $\$\frac{5}{8}$? $\$\frac{7}{8}$? $\$\frac{1}{12}$?
7. How many cents are there in $\$\frac{1}{3}$? $\$\frac{2}{3}$? $\$\frac{1}{6}$?
8. How many dollars are there in 300¢? 150¢? 1000¢?
9. What part of a dollar is 1 d.? 3 d.? 5 d.? 9 d.?
10. What part of a dollar is 25¢? 50¢? 75¢?
11. What part of a dollar is 20¢? 30¢? 60¢?
12. How many dimes are there in \$2.50?

MISCELLANEOUS TABLES

100. Paper

24 sheets = 1 quire
20 quires = 1 ream

101. Counting

12 units = 1 dozen (doz.)
12 dozen = 1 gross (gro.)
12 gross = 1 great gross (G. gro.)
20 units = 1 score

Exercise 91

1. How many sheets of paper are there in 4 quires?

2. How many sheets of paper are there in $\frac{1}{2}$ a quire?

3. How many sheets of paper are there in $3\frac{1}{2}$ quires?

4. Find the cost of $2\frac{1}{2}$ doz. eggs at 30¢ a dozen.

5. What should be paid for 9 oranges at 40¢ a dozen?

6. How many crayons are there in 5 boxes each containing a gross?

7. What should a woman receive for $15\frac{1}{2}$ doz. eggs at \$ 0.32 a dozen?

8. When oranges are selling at the rate of 6 for 15¢, how much should be paid for 2 doz.?

9. How old is a man whose age is 4 score and 10 years?

10. How many score of eggs are there in 5 doz.?

11. When matches are selling at 3 boxes for 10¢, how much is that per gross?

12. When paper is bought at 20¢ per quire, how much is that per ream?

13. What profit is made on 10 doz. notebooks bought at \$ 0.90 a dozen and sold at 10¢ each?

14. 10 eggs weigh about 1 pound; find the weight of 20 doz. eggs.

Find the gain on:

15. 8 doz. notebooks, bought at \$ 1.60 per dozen and sold at 15¢ each.

16. 3 doz. rulers, bought at 50¢ per dozen and sold at 5¢ each.

17. 4 gro. erasers, bought at $3.20 per gross and sold at 5¢ each.

18. 2 gro. pencils, bought at $3.00 per gross and sold at 2 for 5¢.

19. $1\frac{1}{2}$ reams water-color paper, bought at $20 per ream, and sold at 5¢ per sheet.

20. 5 reams drawing paper, bought at 35¢ per ream and sold at 3 sheets for 1¢.

21. 1 quire blotters, bought at 60¢ and sold at 3¢ each.

22. 2 M envelopes, bought at $1.30 per M and sold at 25 for 5¢.

23. 200 shad, bought at $25 per C and sold at $0.50 each.

BILLS AND ACCOUNTS

102. A **bill** is a written statement of the names, quantities, and prices of goods sold or services rendered, together with the names of the parties and the date of the transaction.

103. An **account** is a record of business transactions between two parties at a given date.

104. The **debtor** (Dr.) is the party who buys the goods or receives the services.

105. The **creditor** (Cr.) is the party who sells the goods or renders the services.

106. A **debit** (Dr.) is an entry in a bill or an account against the debtor.

107. A **credit** (Cr.) is an entry in a bill or an account in favor of the debtor.

108. An **item** is any separate debit or credit made in a bill or an account.

109. A bill is **filled** by writing in it the cost of each item, and **footed** by adding the cost of the different items to find the total cost.

110. A Receipted Bill for Goods purchased on the Same Date

any claim for allowance or for correction must be made immediately on receipt of goods. NO GOODS RETURNABLE EXCEPT BY PREVIOUS AGREEMENT not responsible for goods lost or destroyed in transit, or sent or received for inspection.

SILVER, BURDETT & COMPANY

BOSTON NEW YORK CHICAGO — PUBLISHERS OF SCHOOL AND COLLEGE TEXTBOOKS — TWO TWENTY-ONE COLUMBUS AVENUE BOSTON, MASSACHUSETTS — ATLANTA SAN FRANCISCO DALLAS

Date July 31, 1912. No. Via American Express

Mr. Alexander Hamilton,
30 Greene Street,
Washington, D. C.

10	Progressive Road to Reading Book 3	@ .48	4.80	
5	First Year Latin	" 1.00	5.00	
10	Literature in the Schools	" 1.25	12.50	
12	In Fableland	" .45	5.40	
20	New Normal Music Book 2	" .40	8.00	35.70

RECEIVED PAYMENT
JUL 31 1912
SILVER, BURDETT & CO
Per J. J. Jones

Terms net cash: Payable on or before the fifteenth for bills of preceding month. Please remit by Post-office Money Order, Express Money Order, or Boston Exchange. According to rule of Boston Clearing House, checks on local banks are subject to exchange for collection.

111 A Receipted Bill for the Entire Purchases of One Month

DEBTOR TO JACOB REED'S SONS, INC.
Philadelphia, Pa.

Purchases for the Month of *September*, 1912.

MR. T. FRED WOODLEY,
East Bangor, Pa.

DATE			DAILY TOTAL	CREDITS
2	Suit	$38.00		
	Hat	3.00	41.00	
6	Shirt		2.50	
11	Shirt			2.50
12	Shoes		4.00	
15	2 sets underwear	2.00		
	Tie	1.00	3.00	
			50.50	
			2.50	
			48.00	

Received Payment
Oct. 3, 1912
JACOB REED'S SONS
Per J. L. H.

112. An Account

DENVER, COLO., September 3, 1912.

John Clark,

In account with B. B. WITMER

Dr.			
15 yd. White Lawn	*$0.25*	*3 75*	
18 lb. Sugar	*.06*	*1 08*	
20 yd. Carpet	*.80*	*16 00*	*20 83*
Cr.			
15 doz. Eggs	*.30*	*4 50*	
16 lb. Butter	*.36*	*5 76*	*10 26*
Balance,			*10 57*

Exercise 92

1. Extend the items in the following bill and find the total:

Woodbury, N. J., June 15, 1912.

Mr. James Wilson,

To G. G. Green, *Dr.*

Terms Cash.

36 yd. Muslin	*$0.09*			
1 doz. Men's Linen Hdkfs.	*1.80*			
2 pr. Gloves	*.75*			
4 pr. Socks	*.25*			
10 yd. Fancy Ribbons	*.12*			
2 Silk Waists	*6.00*			

Received payment,

2. Extend the items in the following account and find the balance:

Baltimore, Md., April 1, 1912.

Jacob M. Frantz,

In account with Steinman & Co.

Dr.				
1 Gasoline Stove		*4*	*45*	
1 Teakettle and Steamer		*2*	*00*	
2 Preserving Kettles	*$0.75*			
½ doz. Bread Pans	*3.20*			
Cr.				
2 bu. Timothy Seed	*$2.75*			
3 bu. Seed Potatoes	*.80*			
½ bu. Seed Corn	*.90*			
Balance,				

Rule bill forms and on them make out bills for the following articles; use your own name for that of the buyer, and the name of some firm that deals in the articles purchased for that of the seller. Fill, foot, and receipt the bills, dating them appropriately.

3.

$\frac{1}{2}$ lb. tea	@	80 ¢
3 loaves bread	@	5 ¢
3 lb. butter	@	35 ¢
1 bottle olives	@	60 ¢
2 cans corn	@	20 ¢
$5\frac{1}{2}$ gal. vinegar	@	30 ¢

4.

$1\frac{1}{2}$ gal. vinegar	@	30 ¢
$3\frac{1}{2}$ lb. ham	@	12 ¢
3 glasses jelly	@	18 ¢
$\frac{1}{4}$ doz. bottles sirup	@	$2.00
$8\frac{1}{4}$ lb. rice	@	12 ¢
3 lb. white grapes	@	20 ¢

5.

1 lb. cheese	@	25 ¢
5 lb. coffee	@	30 ¢
10 lb. sugar	@	7 ¢
2 lb. lard	@	16 ¢
$15\frac{1}{4}$ doz. eggs	@	30 ¢
1 lb. English walnuts	@	75 ¢

6.

2 qt. cranberries	@	15 ¢
4 lb French prunes	@	25 ¢
5 doz. Fla. oranges	@	50 ¢
6 bottles grape juice, per doz.		$ 2.75
4 glasses Guava jelly	@	35 ¢
$5\frac{1}{2}$ lb. raisins	@	16 ¢

7.

80 bu. wheat	@	96 ¢
62 bu. corn	@	72 ¢
100 bu. oats	@	55 ¢
10 bu. rye	@	85 ¢
$8\frac{1}{2}$ bu. potatoes	@	90 ¢
2 bu. clover seed	@	$10.00

8.

$\frac{1}{4}$ lb. nutmegs	@	60 ¢
6 packages cornstarch	@	5 ¢
100 lb. brown sugar	@	5 ¢
7 lb. coffee	@	35 ¢
$5\frac{1}{2}$ lb. ham	@	15 ¢
3 lb. figs	@	20 ¢

Render each of these bills for the month named in the current year; receipt the bills.

9.	Nov. 12.	1	mission desk	@	$	7.50
		2	Daisy express wagons	@		2.25
		1	auto-coaster	@		18.00
	Nov. 16.	3	hand cars	@	$	5.00
		4	pr. skates	@		2.50
10.	Mar. 14.	1	ladder	@	$	1.80
		2	egg beaters	@		.20
		1	market basket	@		1.00
		2	potato mashers	@		.18
	Mar. 25.	3	cans of corn	@	$	.10
		4	lb. of cheese	@		.18
		2	bottles of olives	@		.30
	Mar. 30.	4	yd. of silk	@	$	.50
		3	pr. silk hose	@		.75
		$4\frac{1}{2}$	yd. silk ribbon	@		.30
11.	Apr. 2.	1	hot water bottle	@	$	1.00
		2	tooth brushes	@		.25
		1	tube of tooth paste	@		.25
		2	tubes of nail enamel	@		.50
	Apr. 4.	1	pr. skates	@	$	1.10
		3	skate straps	@		.10
		4	skate keys	@		.05

	Apr. 6.	1	raincoat	@	$ 2.50
		1	pr. rubbers	@	.55
		2	umbrellas	@	2.50
12.	May 4.	4	yd. gingham	@	$ .12
		6	yd. percale	@	.12½
		8	yd. calico	@	.06
		2	yd. lawn	@	.30
	May 8.	4	lb. butter	@	$ .30
		3	lb. rice	@	.10
		5	lb. soup beans	@	.08
		1	lb. coffee	@	.30
	May 10.	4	cans of tomatoes	@	$ .10
		3	cans of peaches	@	.25
		2	cans of beans	@	.15
		2	cans of peas	@	.12

13. Rule account form and on it make out the following account and find the balance:

Oct. 1, 1912, James Wilson bought of Hiram Leonard, Pittsburg, Pa., 40 bbl. Winter Patent Flour @ $5.60 per barrel; 12 bbl. Winter Straight Flour @ $5.40 per barrel; 14 bbl. Penna Flour @ $4.90 per barrel. At the same time Mr. Leonard bought from James Wilson, 60 bu. No. 2 Red Wheat @ $1.13 per bushel; 60 bu. Corn @ $0.85 per bushel: 50 bu. Oats @ $0.60 per bushel.

DENOMINATE AMOUNTS

113. Denominate units are units established by custom or law to measure capacity, weight, time, length, surface, solids, etc.

Thus, *a gallon, a pound, a day, a yard,* etc., are denominate units.

114. A simple denominate amount is any number of like denominate units.

Thus, 6 *bushels,* $\frac{1}{2}$ of *a yard,* and $2\frac{1}{2}$ *pounds* are simple denominate amounts.

MEASURES OF CAPACITY

Liquid Measure

115. Table

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)
$31\frac{1}{2}$ gallons	= 1 barrel (bbl.)
63 gallons	= 1 hogshead (hhd.)

Barrels are of various sizes, but $31\frac{1}{2}$ gal. is usually taken as the capacity of a barrel unless otherwise stated.

Exercise 93

1. How many pints are there in 4 qt.?
2. One pint is what part of a quart?
3. How many quarts are there in $\frac{1}{2}$ gal.?
4. How many quarts are there in $2\frac{1}{2}$ gal.?
5. How many pints are there in a gallon?

6. How many gills are there in a quart?

7. $\frac{1}{2}$ gal. of alcohol will fill how many gill bottles?

8. What part of a gallon is 2 qt.? 3 qt.?

9. How many quarts are there in 8 pt.? 18 pt.? 24 pt.?

10. How many gallons are there in 24 qt.? 32 qt.? 40 qt.?

11. How many gallons are there in 6 qt.? 10 qt.? 15 qt.? 25 qt.?

Dry Measure

116. **Table**

2 pints (pt.)	**= 1 quart (qt.)**
8 quarts	**= 1 peck (pk.)**
4 pecks	**= 1 bushel (bu.)**

The heaped bushel, which contains about 5 pk., or $\frac{5}{4}$ of a stricken bushel, is used in measuring corn in the ear, potatoes, apples, lime, turnips, and various other substances.

Two bushels of corn in the ear are considered the equivalent of one bushel of shelled corn.

Exercise 94

1. How many quarts are there in 3 pk.?
2. A quart is what part of a peck?
3. How many quarts are there in $\frac{1}{2}$ pk.? $\frac{1}{4}$ pk.?
4. How many quarts are there in a bushel? $\frac{1}{2}$ bu.?
5. One peck is what part of a bushel?
6. Two pecks are what part of a bushel? 3 pk.?

7. How many quarts are there in $1\frac{1}{2}$ bu.?

8. How many half bushels will fill a 3-bu. bag?

9. A trucker put $\frac{1}{2}$ bu. of berries into quart boxes; how many boxes were required?

10. When clover seed sells for \$12 per bushel, how much is that per peck?

11. Find the cost of $2\frac{1}{2}$ bu. of clover seed at \$10 per bushel.

12. When potatoes are selling at 30¢ a peck, how much is that per bushel?

13. How many bushel sacks will hold 25 pk. of seed, and how many pecks over?

14. How many quart boxes will be required to hold 2 bu. of cherries?

MEASURES OF WEIGHT

Avoirdupois Weight

117. **Table**

16 ounces (oz.)	**= 1 pound (lb.)**
2000 pounds	**= 1 ton (T.)**

100 lb. is sometimes called 1 *hundredweight* (cwt.). Goods are frequently shipped by the hundredweight.

The long ton, 2240 pounds, is used in custom houses and sometimes elsewhere, especially in selling coal. Anthracite coal is always sold at the mines, and often retailed, by the long ton. Bituminous coal is frequently sold in the same way.

Weights of Grains, Seeds, and Other Produce

118. The following table gives the number of pounds in a bushel of various commodities as used by the Boards of Trade in the principal cities of the United States:

Table

Commodities	Lb.	Commodities	Lb.	Commodities	Lb.
Barley	48	Corn (shelled)	56	Peas	60
Beans	60	Corn (on cob)	70	Rye	56
Buckwheat	48	Clover seed	60	Timothy seed	45
Bran	20	Oats	32	Wheat	60

119. Weights of Everyday Things

A barrel of flour weighs	196 lb.
A barrel of salt weighs	280 lb.
A barrel of pork, beef, or fish weighs	200 lb.
A bushel of coarse salt weighs	56 lb.
A keg of nails weighs	100 lb.
A firkin of butter weighs	56 lb.
A keg of powder weighs	25 lb.
A bushel of Portland cement weighs	96 lb.
A bushel of loose lime weighs	70 lb.

Exercise 95

1. What should $\frac{1}{2}$ bu. of shelled corn weigh?
2. What should a peck of clover seed weigh?
3. What should $\frac{1}{2}$ a peck of oats weigh?

4. How many bushels of bran should there be in 100 lb.?

5. What should $\frac{1}{2}$ bu. of timothy seed weigh?

6. What should 4 oz. of cheese cost at 16¢ per pound?

7. How many more pounds are there in a long ton than in a short ton?

8. What should 1000 lb. of hay cost at $18 per ton?

9. How many 200-lb. sacks of fertilizer will make a ton?

10. How much should a peck of barley weigh?

11. How many bales of hay, each weighing 4 hundredweight, will make a ton?

12. What will $\frac{1}{4}$ lb. of spices cost at 5¢ an ounce?

13. What will 1 lb. 12 oz. of dried beef cost at 24¢ per pound?

120. Find the cost of 4500 lb. of hay at $18.50 per ton.

4500 lb. = 4.500 M lb. = 2.25 T.
$18.50 = the cost per T.

$$\begin{array}{r} 2.25 \\ \hline 92\ 50 \\ 370\ 0 \\ 3700 \\ \hline 41.6250 \end{array}$$

, or $41.63 = the entire cost.

Exercise 96

Find the cost of:

1. 1870 lb. of bran at $18 per ton.
2. 3880 lb. of straw at $6 per ton.
3. 4660 lb. of fertilizer at $14 per ton.

4. 1840 lb. of hay at $18 per ton.

5. 3250 lb. of mixed feed at $20 per ton.

6. 8560 lb. of phosphate at $18 per ton.

7. 10750 lb. of iron ore at $6 per ton.

8. 270 lb. of bran at $21 per ton.

9. 3420 lb. of old iron at $20 per ton.

10. 4590 lb. of coal at $6 per ton.

11. What should be paid for 1830 lb. of wheat at $0.98 per bushel?

12. What should be paid for 2856 lb. of wheat at $0.90 per bushel?

13. What should be paid for 3856 lb. of oats at $0.50 per bushel?

14. What should be paid for 2900 lb. of oats at $0.48 per bushel?

MEASURES OF TIME

121. Table

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (da.)
7 days	= 1 week (wk.)
52 weeks	= 1 year (yr.), nearly
365 days	= 1 common year
366 days	= 1 leap year
100 years	= 1 century

NOTE 1. — **A centennial year is one whose number is divisible by 100.**
Thus, 400, 1800, and 1900 were centennial years.

NOTE 2. — A centennial year whose number is divisible by 400, or any other year whose number is divisible by 4, is **a leap year.**
Thus, 1600, 1896, and 1904 were leap years.

NOTE 3. — A.M. stands for *forenoon;* P.M. stands for *afternoon:* 7.45 P.M. means 45 *minutes past* 7 P.M.

Exercise 97

1. The winter months are December, January, and February; how many days are there in the winter months?

2. A family that uses 2 qt. of milk a day spends how much for milk during March, the cost of the milk being 6¢ a quart?

3. Name the 7th day of the week; the 5th; the 2d; the 1st; the 4th; the 3d; the 6th.

4. Name the months that have 30 days.

5. When a pulse beats 18 times in 15 seconds, how many times does it beat in a minute?

6. A building was erected in MDCCCXC; how many years ago was that?

7. Name the months that have 31 days.

8. One coin is dated 1880, another 1912; how many years are there between their dates?

9. Name the 11th month; the 4th; the 7th; the 12th; the 8th; the 3d; the 6th; the 1st; the 9th; the 2d; the 5th; the 10th.

10. Name the Roman letters that are used to write the number of the present year.

11. At 20¢ an hour, how much will a motorman earn from 6 A.M. to 3 P.M.?

12. How much rent was paid in 1 yr. 6 mo. for a house that rented for $ 20 a month?

13. When a hotel is charging 50¢ a meal and $1 for lodging, how much is it charging per week at the same rate?

MEASURES OF LENGTH

122. The standard unit of length is the **yard.**

Table

12 inches (in.)	= 1 foot (ft.)
3 feet	= 1 yard (yd.)
$5\frac{1}{2}$ yards	= 1 rod (rd.)
320 rods	= 1 statute mile (mi.)

123. Other Measures of Length

A fathom = 6 ft., used to measure the depth of the sea.

A hand = 4 in., used in measuring a horse's height.

A geographic mile, or knot = 6086 ft.

A league (England and U. S.) = 3 geographic miles, used to measure distances at sea.

A chain = 4 rd., used by surveyors in measuring land.

Exercise 98

1. How many inches are there in 3 ft.? in $\frac{1}{2}$ ft.? in $1\frac{1}{2}$ ft.?

2. How many feet are there in 3 yd.? in $\frac{1}{2}$ yd.? in $1\frac{1}{2}$ yd.?

3. How many 6-in. ropes can be cut from a rope 8 ft. long?

4. A 6-in. rule is what part of a foot long?

5. A 4-in. rule is what part of a foot long?

6. An 18-in. rule is how many feet long?

7. A horse that is $14\frac{1}{2}$ hands high is how many inches high?

8. What is the distance around a room 24 ft. long and 10 ft. wide?

9. A yardstick was marked off in inches; how many inches?

10. 1 rd. $= 5\frac{1}{2} \times 3$ ft., or —— ft.

11. The ocean, at a certain place, is 80 fathoms deep; how many feet is that?

12. How many inches are there in $\frac{1}{4}$ yd.? in $\frac{3}{4}$ yd.?

13. What part of a yard is a foot?

14. What part of a yard is 6 in.?

15. What is the distance around a boy's hoop if it turns 4 times in a distance of 20 ft.?

16. In ordinary walking, the pace is $2\frac{1}{2}$ ft.; how many feet are there in 10 paces?

ANGLES

124. The opening between two straight lines drawn from the same point is called an **angle.**

Thus, Fig. 1 is an angle.

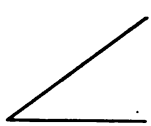


Fig. 1

Fig. 2

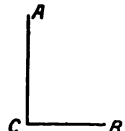


Fig. 3

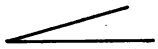
125. If one straight line meets another straight line so as to form two equal angles, each angle is called a **right angle**; as Fig. 2.

126. When one straight line meets another straight line so as to form with it a right angle, the lines are said to be **perpendicular** to each other.

Thus, *AC* and *BC*, Fig. 3, are perpendicular to each other.

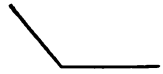
NOTE.—Notice that if *BC* were extended, *AC* would form with *BC* two equal angles.

127. An **acute angle** is an angle that is less than a right angle. An **obtuse angle** is an angle that is greater than a right angle.



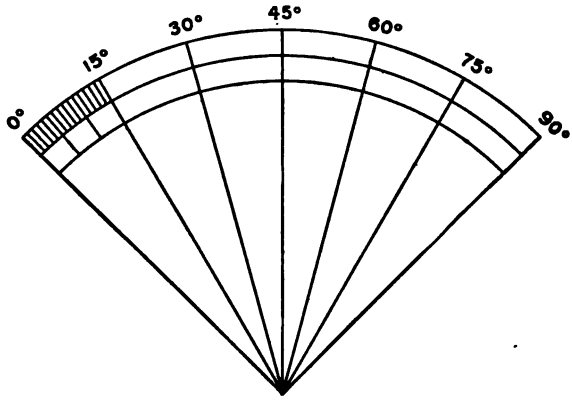
Acute Angle

Right Angle



Obtuse Angle

128. An angle equal to $\frac{1}{90}$ of a right angle is an angle of 1 degree, which is the unit of angles; $\frac{1}{60}$ of an angle of



1 degree is an angle of 1 minute; and $\frac{1}{60}$ of an angle of 1 minute, an angle of 1 second.

129. **Table**

60 seconds	(″)	= 1 minute (′)
60 minutes		= 1 degree (deg. or °)
90 degrees		= 1 right angle (rt. ∠)

Exercise 99

Read these angles:

1. 15°; 15° 30′; 15° 30′ 30″.
2. 35°; 10° 25′; 45° 32′ 20″.
3. 47°; 50° 38′; 86° 20′ 15″.

Write, using the proper symbols:

4. 3 degrees; 5 degrees, 6 minutes; 7 degrees, 8 minutes, 10 seconds.

5. 10 degrees; 14 degrees, 30 minutes; 21 degrees, 5 minutes, 4 seconds.

6. 32 degrees; 16 degrees, 25 seconds; 8 degrees, 15 minutes, 2 seconds.

7. Draw an acute angle; an obtuse angle.

8. A right angle will make how many 30° angles? how many 45° angles?

9. How many minutes are there in 2°? 3°?

10. How many minutes are there in 1° 30′?

11. What kind of angle does the hour hand make with the minute hand at 3 o'clock?

12. What kind of angle does the hour hand make with the minute hand at 9 o'clock?

13. If one line runs north and another east, what kind of angle do they make with each other?

14. Northeast is halfway between north and east; how many degrees are there between two lines one running north and the other running northeast from the same point?

15. How many degrees are there between two lines one running northeast and the other running east from the same point?

SURFACES

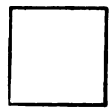
130. Anything that has length and breadth without thickness is called **surface.**

131. A surface on which any number of straight lines can be drawn in different directions is a **plane surface.**

132. The *number* of square units in a surface is its **area.**

The Square

133. A **square** is a plane figure that has four equal sides and four right angles.



134. 1. A **square inch** is a square 1 inch long.

2. A **square foot** is a square 1 foot long.

3. A **square yard** is a square 1 yard long.

4. A **square rod** is a square 1 rod long.

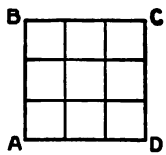
5. A **square mile** is a square 1 mile long.

6. A **square unit** is a square 1 unit long.

135. The result obtained by using a number twice as a factor is the **square** of the number.

Thus, 3×3, or 9, is the square of 3.

136. $ABCD$ is a square 3 units long.



3 = the number of square units in 1 row.

3 = the number of rows of square units.

3×3, or 9 = the number of square units in $ABCD$.

NOTE. — 3×3 may be written 3^2, read *3 squared.*

137. The area of a square is the square of the number of units in its length.

Exercise 100

1. A square 1 foot long is how many inches long?

2. How many square inches are there in a square 12 in. long?

3. How many feet long is a square a yard long?

4. Represent on the blackboard a square 1 yd. long; scale: $2'' = 1'$. Show how many square feet this square contains.

5. How many square feet are there in a square yard?

6. Represent on the blackboard a square $5\frac{1}{2}$ yd. long; scale: $2'' = 1'$. Show how many square yards this square contains.

7. 1 sq. rd. = ——— sq. yd.

138. Table

144 square inches (sq. in.)	**= 1 square foot (sq. ft.)**
9 square feet	**= 1 square yard (sq. yd.)**
$30\frac{1}{4}$ square yards	**= 1 square rod (sq. rd.)**
160 square rods	**= 1 acre (A.)**

A square rod is also called a **perch.**

Exercise 101

1. Point out three plane surfaces in this room.

2. Point out three surfaces that are not plane.

3. How many square inches are there in a square 2 in. long (a 2-in. square)?

4. How many square inches are there in a 4-in. square?

5. How many square inches are there in a 5-in. square?

6. A square $\frac{1}{2}$ ft. long contains what part of a square foot? How many square inches does it contain?

7. Make a drawing representing a square 40 rd. long; scale: $2'' = 5$ rd. How many acres are there in this square?

8. Make a drawing representing a square 4 rd. long; scale: $2'' = 1$ rd. What part of an acre does this square contain?

9. How many squares 4 rd. long contain an acre?

10. How many square feet are there in a square rod?

11. How many square yards are there in an acre?

12. How many square feet are there in an acre?

13. What is the distance around (the **perimeter** of) a square 40 rd. long?

14. What is the perimeter in feet of a square lawn 50 yd. long?

15. Find the cost at 40¢ per rod of a fence that will inclose a square garden 66 ft. long.

16. How many acres are there in a tract of land in the form of a square 80 rd. long?

17. How many square rods are there in a square mile?

18. Divide the number of square rods in a square mile by 160 to find the number of acres in a square mile?

19. How many square feet of paper will cover a box 2 ft. long, 2 ft. wide, and 2 ft. high?

20. In some parts of the country a township is considered a square 6 mi. long; how many square miles in such a township?

21. How many square feet are there in the walls and ceiling of a bathroom 10 ft. long, 10 ft. wide, and 10 ft. high?

22. How many square feet are there in the entire outside surface of a cubical box 3 ft. long?

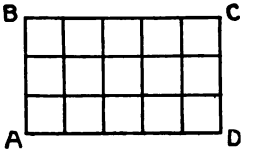
The Rectangle

139. Parallel lines are lines that lie in the same plane and cannot meet however far produced.

140. A **rectangle** is a plane figure that has four sides and four right angles.

141. The opposite sides of a rectangle are equal and parallel.

142. *ABCD* is a rectangle 5 units long and 3 units wide.



5 = the number of square units in each row.

3 = the number of rows.

3×5, or 15, = the number of square units in *ABCD*.

143. The area of a rectangle is the number of units in its length multiplied by the number of units in its width.

Exercise 102

1. What is the perimeter of a rectangle 3 ft. long and 2 ft. wide?

2. What is the perimeter of a rectangle 20 rd. long and 8 rd. wide?

3. How many square feet are there in a floor 14 ft. long and 10 ft. wide?

4. How many acres are there in a rectangle 20 rd. long and 8 rd. wide?

5. How many square feet are there in the ceiling of a room 20 ft. long and 18 ft. wide?

6. How many square yards of bunting will make a flag $4\frac{1}{2}$ yd. long and 3 yd. wide?

7. How many square yards of plastering are there in the walls and ceiling of a room 18 ft. long, 12 ft. wide, and 9 ft. high?

8. How many square inches are there in a sheet of paper $12\frac{1}{2}$ in. long and $7\frac{1}{2}$ in wide?

9. Find the number of square feet in a rug 24 in. by 26 in.

10. Find the number of square inches in a rug 27 in. by 54 in.

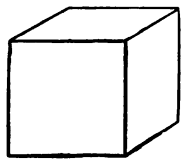
11. Find the number of square feet in a rug $4\frac{1}{2}$ ft. by $7\frac{1}{2}$ ft.

12. Find the number of square feet in a rug $7\frac{1}{2}$ ft. by $10\frac{1}{2}$ ft.

MEASURES OF SOLIDS

144. Anything that has length, breadth, and thickness is a **solid**.

The Cube



145. A **cube** is a solid bounded by six equal squares.

146. The **edges** of a cube are the lines in which the squares meet, and the **faces** are the equal squares.

147.

1. A **cubic inch** is a cube an inch long.

2. A **cubic foot** is a cube a foot long.

3. A **cubic yard** is a cube a yard long.

4. A **cubic unit** is a cube a unit long; that is, a cube of any desired length.

NOTE. — The result obtained by using a number three times as a factor is the cube of the number.

Thus, $3 \times 3 \times 3$, or 27, is the cube of 3.

148. This figure represents a cube 3 units long.

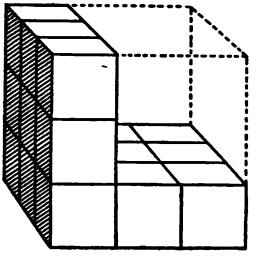
3 = the number of cubic units in one row.

3 = the number of rows.

3×3 = the number of cubic units in one layer.

3 = the number of layers.

$3 \times 3 \times 3$ = the number of cubic units in the cube.



NOTE. — $3 \times 3 \times 3$ may be written 3^3, read *3 cubed.*

149. The number of cubic units in a cube equals the cube of the number of units in the length.

Cubic Measure

150. A cubic foot is a cube 12 in. long.

$12 \times 12 \times 12$, or 1728, = the number of cubic inches in 1 cubic foot.

A cubic yard is a cube 3 ft. long.

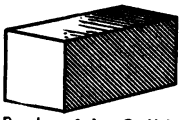
$3 \times 3 \times 3$, or 27, = the number of cubic feet in 1 cubic yard.

151. Table

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)

The Rectangular Solid

152. A **rectangular solid** is a solid all of whose faces are rectangles.



Rectangular Solid

153. This figure represents a rectangular solid 4 units long, 3 units wide, and 2 units high. The number of cubic units in it is found thus:

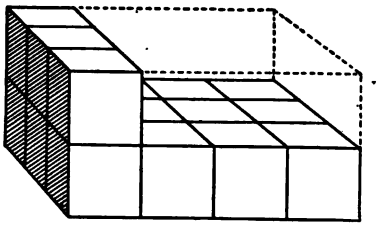
4 = the number of cubic units in 1 row.

3 = the number of rows.

3 × 4 = the number of cubic units in 1 layer.

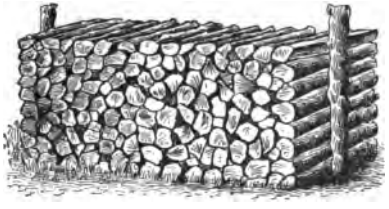
2 = the number of layers.

2 × 3 × 4, or 24, = the number of cubic units in the rectangular solid.



154. The number of cubic units in a rectangular solid equals the number of units in the height, times the number of units in the width, times the number of units in the length.

155. Wood Measure



A pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high is called a **cord**.

Important Facts

A cubic yard of earth is called a **load**.
A cubic foot of water weighs $62\frac{1}{2}$ lb.
A stricken bushel = about $\frac{5}{4}$ of a cubic foot.
A heaped bushel = about $\frac{25}{16}$ of a cubic foot.
A cubic foot of anthracite coal broken averages 54 lb.
400 cubic feet of hay in a mow is considered a ton.
231 cubic inches = 1 wine gallon.
$24\frac{3}{4}$ cubic feet of masonry is called a **perch**.

Exercise 103

1. How many cubic inches are there in a cube 4 in. long?
2. How many cubic feet are there in a cube 5 ft. long?
3. Two cubic yards are how many cubic feet?
4. How many cubic inches are there in 3 cu. ft.?
5. A cubical box 5 ft. long will hold how many bushels of oats, estimating that 1 bu. = $1\frac{1}{4}$ cu. ft.?

6. How many bushels of wheat will a cubical box hold that is 3 ft. long, estimating that 1 bu. of wheat equals $1\frac{1}{4}$ cu. ft.?

7. How many cubic inches are there in a rectangular solid 3 in. long, 2 in. wide, and 1 in. high?

8. How many cubic feet of sand will a box hold that is 5 ft. long, 4 ft. wide, and 2 ft. high?

9. How many cubic feet of air are there in a room 15 ft. long, 12 ft. wide, and 9 ft. high?

10. How many cubic yards of earth must be removed in digging a cellar 27 ft. long, 18 ft. wide, and 10 ft. deep?

11. Show that there are 128 cu. ft. in a cord.

12. Show that a wall $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. thick, and 1 ft. high contains $24\frac{3}{4}$ cu. ft., or 1 perch.

13. Show that a vessel 11 in. long, 7 in. wide, and 3 in. deep holds 231 cu. in., or 1 gal.

14. How many gallons of water will a cistern hold that is 28 ft. long, 22 ft. wide, and 12 ft. deep?

SUGGESTION. — $\frac{28 \times 12 \times 22 \times 12 \times 12 \times 12}{11 \times 7 \times 3}$ = the number of gallons. (Explain why.)

15. One bushel = about $1\frac{1}{4}$ cu. ft. At this estimate, how many bushels of wheat will a granary hold that is 10 ft. long, 8 ft. wide, and 5 ft. deep?

16. One heaped bushel = about $1\frac{9}{16}$ cu. ft. At this estimate, how many bushels of potatoes will a bin hold that is 15 ft. long, 10 ft. wide, and 6 ft. deep?

17. How many cords of wood are there in a pile 256 ft. long, 4 ft. wide, and 4 ft. high?

18. A mow of hay is 40 ft. long, 20 ft. wide, and 16 ft. high. Estimating 400 cu. ft. to the ton, how many tons of hay are there in this mow?

19. How many loads of earth, estimating a cubic yard to a load, must be removed in digging a cellar for a house 32 ft. long, 18 ft. wide, and 9 ft. deep? Cancel.

20. What is the weight of the water that a tank 4 ft. long, 2 ft. wide, and 1 ft. deep will hold, water weighing $62\frac{1}{2}$ lb. per cubic foot?

21. Milk is about 1.03 times as heavy as water, which weighs 62.5 lb. per cubic foot. What is the weight of a cubic foot of milk?

22. How many cubic feet of masonry in a wall 50 ft. long, $1\frac{1}{2}$ ft. thick, and 10 ft. high?

REDUCTION

156. 1. Reduce 6 bu. to pints.

Explanation

6 bu. = 6 × 4 pk., or 24 pk.
24 pk. = 24 × 8 qt., or 192 qt.
192 qt. = 192 × 2 pt., or 384 pt.
∴ 6 bu. = 384 pt.

The answer may be found thus:

$$\begin{array}{r} 4 \\ 6 \\ \hline 24 \\ 8 \\ \hline 192 \\ 2 \\ \hline 384 \end{array}$$

24, the number of pecks.
192, the number of quarts.
384, the number of pints.

2. Reduce 116 pints to gallons.

Explanation

The no. of pints ÷ 2 = the no. of qt.
58 = the no. of qt.
The no. of quarts ÷ 4 = the no. of gal.
∴ $14\frac{1}{2}$ = the no. of gal.
∴ 116 pt. = $14\frac{1}{2}$ gal.

The answer may be found thus:

2)116, no. of pt.
4)58, no. of qt.
$14\frac{1}{2}$, no. of gal.

Exercise 104

1. Reduce 5 da. to hours.
2. Reduce 8 hr. to minutes.
3. Reduce $8\frac{1}{2}$ gal. to quarts.
4. Reduce 12 lb. to ounces.
5. Reduce 10 ft. to inches.
6. Reduce 16 rd. to yards.
7. Reduce $16\frac{3}{4}$ lb. to ounces.
8. Reduce 4 gal. to pints.
9. Reduce 12 bu. to quarts.
10. Reduce 6 hr. to seconds.
11. Reduce 8 rd. to feet.
12. Reduce 6 sq. yd. to square feet.
13. Reduce 8 sq. ft. to square inches.
14. Reduce 4 sq. yd. to square inches.
15. Reduce 8 A. to square rods.
16. Reduce 5 A. to square yards.
17. Reduce 7° to minutes.
18. Reduce 3° to seconds.

19. Reduce 16 pt. to quarts.
20. Reduce 35 qt. to gallons.
21. Reduce 156 da. to weeks.
22. Reduce 144 oz. to pounds.
23. Reduce 56 pt. to gallons.
24. Reduce 66 pt. to gallons.
25. Reduce 128 pt. to pecks.
26. Reduce 150 pt. to pecks.
27. Reduce 180 in. to yards.
28. Reduce 300 in. to yards.
29. Reduce 840 hr. to weeks.
30. Reduce 960 hr. to weeks.
31. Reduce 60 pt. to gallons.
32. Reduce 400 lb. of oats to bushels.
33. Reduce $3\frac{1}{2}$ yd. to inches.
34. Reduce $7\frac{3}{4}$ gal. to pints.
35. Reduce $2\frac{1}{2}$ sq. yd. to square inches.
36. Reduce $1\frac{1}{2}$ A. to square yards.
37. Reduce $3\frac{3}{4}$ bu. to quarts.
38. Reduce 172 qt. to bushels.
39. Reduce 4500′ to degrees.
40. Reduce $2\frac{1}{2}$ reams to sheets.
41. Reduce $3\frac{1}{4}$ gross to units.
42. Reduce 750 lb. of wheat to bushels.

GENERAL REVIEW

Exercise 105

1. The product of two numbers is 1728 and one of them is 24; what is the other?

2. When a number is divided by 12, the quotient is 16 and the remainder 4; what is the number?

3. A man earned $\$2\frac{1}{2}$ a day and his expenses were \$1 a day; how much did he save in 26 days?

4. Multiply the sum of $3\frac{1}{2}$ and $2\frac{3}{4}$ by $12\frac{1}{2}$.

5. If two pencils cost 5¢, what should a dozen cost at the same rate?

6. What is my bill if I buy 4 lb. of butter at 32¢ a pound, $2\frac{1}{2}$ doz. eggs at 30¢ a dozen, and 6 lb. of lard at 12¢ a pound?

7. If pencils are bought for \$1 a gross, and sold at 2¢ each, what is the profit on a gross?

8. \$500 was the amount paid for admissions to a base-ball game; if the players received \$125, what part of the amount paid for admissions did they receive?

9. I have 5 dimes, 30 nickels, 2 quarter dollars and 1 half dollar; how much less than \$5 have I?

10. If I paid \$1.44 for $4\frac{1}{2}$ doz. of eggs, how much was that per dozen?

11. I paid \$2.25 for 15 doz. bananas; how much did 3 doz. cost at the same rate?

12. Multiply at sight $3 \times \frac{3}{8}$; $3 \times \frac{2}{6}$; $3 \times 1\frac{1}{3}$; $3 \times 1\frac{1}{6}$; $3 \times 1\frac{1}{2}$.

13. How much does 5 exceed the sum of $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{6}$, and $\frac{5}{12}$?

14. If I buy potatoes at \$1 a bushel and retail them at 20¢ a half peck, how much profit do I make on a bushel?

15. A man received \$ 5 for working 2 days; how much should he receive for 6 days' work at the same wages per day?

16. How much will 20 yd. of Brussels carpet cost if I buy it at 75¢ a yard?

17. The sum of 4 numbers is 156; the first is $21\frac{1}{2}$, the second $49\frac{3}{4}$, and the third $35\frac{2}{3}$. What is the fourth?

18. Beef scraps for poultry can be bought at the rate of 5 lb. for 25¢. 100 lb. can be bought for \$ 3.50. How much more must be paid for 100 lb. bought in quantities of 5 lb. rather than as one quantity of 100 lb.?

19. Porcelain nest eggs can be bought for 5¢ each, or 25¢ per dozen; how much less will a dozen cost if bought in one quantity rather than separately?

20. From a cheese containing 18 lb., $3\frac{1}{2}$ lb. were sold to one person and $2\frac{1}{4}$ lb. to another; how much then remained?

21. Write the table of Length.

22. Knowing that 3 ft. = 1 yd. and $5\frac{1}{2}$ yd. = 1 rd., find how many feet there are in a rod.

23. How many rods are there in $\frac{1}{2}$ a mile?

24. How many bushels of corn, worth 90¢ a bushel, must be given for 5 barrels of flour worth \$5.40 a barrel?

25. At 20¢ an hour how much will a man earn in a week who works 8 hours on Monday, $7\frac{1}{2}$ hours on Tuesday, 8 hours on Wednesday, $9\frac{1}{2}$ hours on Thursday, 7 hours on Friday, and $4\frac{1}{2}$ hours on Saturday?

26. At $22 a ton how much should 1000 lb. of hay cost?

27. Find the cost of 2000 posts at $20 per C.

28. Find the cost of 2 qt. of sirup at 50¢ a gallon.

29. If a mow of hay is 30 ft. long, 20 ft. wide, and 10 ft. high, how many tons should there be in it, counting 400 cubic feet to 1 ton?

30. Write all the numbers that can be formed each with the figures 1, 2, and 3. Find the sum of the numbers.

31. What part of the week has passed by midnight Thursday?

32. How many square inches are there in a $2\frac{1}{2}$-in. square?

33. How many yards are there in the distance around a square whose length is 1 rod?

34. Find the number of square inches in a sheet of paper 10 in. long and $8\frac{1}{2}$ in. wide.

35. Name at sight the quotients: $\frac{3}{8} \div 3$; $\frac{2}{5} \div 3$; $3\frac{3}{5} \div 3$; $3\frac{1}{3} \div 3$.

36. 5280 ft. make a mile; how many feet are there in $\frac{3}{4}$ of a mile?

37. How many feet are there in 6 fathoms?

38. Find the cost of 500 lb. of bran at $22 per ton.

39. How many days must a man labor to save $20 if his wages are $1\frac{3}{4}$ a day, and his expenses are $1\frac{1}{8}$ a day?

40. Write in figures $1\frac{1}{2}$ million.

41. How many thousand make a million?

42. The distance around the earth is about 25,000 miles; how long would it require a train to run this distance, running 50 miles an hour?

43. How many days are there in a common year? in a leap year?

44. In one common year there are how many weeks and how many days over?

45. A dealer bought $2\frac{1}{2}$ doz. hats for $72; what should he sell them for apiece to gain 60¢ on each hat?

46. Find the cost at 30¢ a square yard of a piece of oilcloth 4 yd. long and $1\frac{1}{4}$ yd. wide.

47. If 5 men do a piece of work in $8\frac{1}{4}$ days, how long should it take one man to do it?

48. Name at sight the answers: $10 \times .1$; $10 \times .02$; 10×20; $10 \times .002$.

49. Name at sight the answers: $.1 \div 10$; $.02 \div 10$; $.01 \div 10$; $25 \div 10$.

50. Wheat weighs 60 lb. to the bushel and corn 56 lb.; what is the weight of the grain a farmer is hauling, if his load consists of 20 bu. of wheat and 18 bu. of corn?

51. When potatoes are selling at 15¢ per ½ peck, how much is that a bushel?

52. How much would 12 oz. of cheese cost at 18¢ a pound?

53. How many 500-lb. bales of cotton are required to weigh 10 tons?

54. Find the cost of all:

Fruit picker	$0.75
Hatchet	0.65
Hanging Basket	0.35
Scythe	1.35

55. Find the amount of this thrashing bill:

350 bu. of wheat at 4¢ a bushel;
320 bu. of oats at 2¢ a bushel;
4 men at $1.50 per day, for a day and a half.

56. How many acres are there in a field 80 rods long and 50 rods wide?

57. How many days will it take to plow a field 40 rods long and 30 rods wide if a man plows at the rate of 1½ acres per day?

58. A man who is paid 5¢ for every dollar of a debt that he collects, is paid how much for collecting a debt of $200?

59. What is the square of 3? 4? 5?

60. Name instantly the square of each number from 1 to 12.

61. The distance around a rectangle is 10 yd.; if its length is 4 yd. what is its width?

62. If A is 10 miles east of a certain town and B is 5 miles west of it, how far are they apart?

63. Two sheep cost \$12 and a lamb cost $\frac{1}{2}$ as much as 1 sheep; what did they all cost?

64. A dealer sold 4 bushels of potatoes for \$6; he made a profit of \$1; what did each bushel of potatoes cost him?

65. How many cubic inches are there in a rectangular solid 11 in. long, 7 in. wide, and 3 in. deep? The answer is the number of cubic inches in what measure?

66. If 6 men do a piece of work in a day, in what time should 3 men do the work?

67. A dealer bought 5 doz. boxes of strawberries for \$4.80; he sold $\frac{1}{2}$ of them at 12 ¢ a box and the other $\frac{1}{2}$ at 10 ¢ a box; what was his profit?

68. Find the sum of .1, .01, and .001.

69. Write all the decimals you can, each with the figures 2, 3, 4, and only these.

70. If chestnuts were bought at \$2 a bushel and retailed at 10 ¢ a quart, what was the profit per bushel?

71. If the edge of a cube is a foot, what is the combined length of all its edges?

72. How many quart boxes will $2\frac{1}{2}$ bu. of berries fill?

73. How many 2-in. squares can be cut from a piece of cardboard 3 in. square?

74. How many square inches are there in all the faces of a cube 2 in. long?

75. Name the leap years between 1910 and 1930.

76. How many quarts of ice cream must be bought for a company of 10 persons, if one pint is sufficient for 2 persons?

77. The seventh day from to-day comes on what day of the week?

78. A farmer who wishes to use 400 lb. of fertilizer for an acre should purchase how many pounds for 10 acres? how many tons?

79. A laborer who works 10 hours a day and begins work at 6.30 A.M. should quit work at what time if he takes one hour for dinner?

80. How many half-gill bottles are required to hold a pint of ink?

81. What should be charged for 700 lb. of feed at $24 a ton?

82. A school that opens at 9.30 A. M. and closes at 2.30 P. M. is how many hours in session provided there are no intermissions?

83. How many bushels of wheat will fill a bin 5 ft. long, 4 ft. wide, and 3 ft. deep if each bushel is $\frac{5}{4}$ of a cubic foot?

84. How many cubic feet of air are there in a room 20 ft. long, 15 ft. wide, and 10 ft. high?

85. When matches are selling at 3 boxes for 5¢, how much is that per gross?

86. Find the gain on $\frac{1}{2}$ a ream of water-color paper bought for \$24 per ream and sold at 6¢ a sheet.

87. Find the cost of shipping 700 lb. of furniture if the freight is 40¢ per hundred.

88. Cast iron weighs about 7.2 as much as water; what is the weight of a cubic foot of cast iron, water weighing 62,5 lb. per cubic foot?

89. A merchant had on hand, at the beginning of a day's sales, \$52.75. During the day he took in \$215.18 cash and paid out \$32.28 cash. How much money had he on hand at the close of the day?

90. How many dozen are there in 12 score?

91. Find the cost of 1200 lb. of straw at \$8 a ton.

92. A farmer's wheat crop weighed, when sold, 19,230 lb.; what did he receive for it if he sold it at \$1.10 per bushel (60 lb.)?

93. A farmer bought 8 steers for \$32 a head, and after feeding them for 6 months at a cost of \$35 a month, sold them for \$498; find the average gain per head.

94. A common brick is 8 in. long, 4 in. wide, and 2 in. thick; how many square inches are there in its surface?

95. Timothy seed weighs 46 lb. to the bushel; what should be the weight of a peck of it?

96. When clover seed is selling for \$12 per bushel (60 lb.), what should be paid for 45 lb. of clover seed?

PART TWO

WHOLE NUMBERS

READING AND WRITING LARGE NUMBERS

Exercise 1

1. Starting at units, name the orders to millions.

2. Starting at units' period, name the periods to billions.

3. What is the name of the third period? the fourth? the second?

4. Name the number made up of 4 units of the third order, 5 of the second, and 6 of the first.

5. Write in figures the number consisting of 6 units of the fourth period, 24 of the third, 6 of the second, and 1 of the first.

6. Write in words 7,005,020.

7. In 4,756,321 tell for what each figure stands; tell for what numbers the figures in the different periods stand.

8. Read and write in words 3,684,531,249.

9. Read:

There were produced in the United States during a recent year 2,772,376,000 bushels of corn, 737,189,000 bushels of wheat, 1,007,353,000 bushels of oats, 170,284,000 bushels of barley, 32,239,000 bushels of rye, and 17,438,000 bushels of buckwheat.

10. The population of the earth is about one and a half billion. Write this number in figures.

ADDITION AND SUBTRACTION

Exercise 2

Add upward; add across (Add each example in less than 5 minutes):

1. $3278 + 6017 + 5923 + 7409 = \bullet$
   $6724 + 3984 + 7018 + 6934 = \bullet$
   $5027 + 5673 + 4216 + 8451 = \bullet$
   $5374 + 6709 + 3980 + 4879 = \bullet$
   $\bullet + \bullet + \bullet + \bullet = \bullet$

2. $5609 + 6322 + 7804 + 3219 = \bullet$
   $6371 + 6123 + 4076 + 5346 = \bullet$
   $7432 + 8095 + 4367 + 7236 = \bullet$
   $2367 + 7809 + 9762 + 5879 = \bullet$
   $\bullet + \bullet + \bullet + \bullet = \bullet$

Add upward; subtract across:

3. $7865 - 3476 = \bullet$
$5982 - 4219 = \bullet$
$6809 - 5189 = \bullet$
$9385 - 6357 = \bullet$
$8906 - 5314 = \bullet$
$\bullet - \bullet = \bullet$

4. $57643 - 32608 = \bullet$
$69075 - 45238 = \bullet$
$83341 - 57649 = \bullet$
$75643 - 34986 = \bullet$
$95014 - 57463 = \bullet$
$\bullet - \bullet = \bullet$

5. In 1910 the United States produced 695,443,000 bushels of wheat; all the countries of the world produced 3,626,336,000 bushels. How much was produced outside of the United States?

6. 3,125,713,000 bushels of Indian corn were produced in the United States in 1910 and 2,772,376,000 bushels in 1909. How many bushels were produced both years? What was the increase for 1910 over 1909?

7. In 1910 Iowa produced the greatest yield of oats in the United States, 181,440,000 bushels; Illinois produced the next largest quantity, 171,000,000 bushels. What was the difference in yield in the two states?

8. In 1910 Illinois produced more corn than any other state, 414,812,000 bushels; Iowa produced the next greatest quantity, 343,900,000 bushels. What was the difference in yield in these two states?

9. In 1910 Texas produced more cotton than any other state, 3,135,000 bales; Georgia produced the next greatest quantity, 1,881,000 bales. How much did these two states together produce? What was the difference in yield?

10. A farmer sold 4 loads of corn. The wagon and corn were first weighed and afterwards the wagon; find the weight of the corn in each load and fill in the totals:

Loads	Gross Weight	Weight of Wagon	Weight of Corn
First . . .	4370 lb.	1273 lb.	
Second . .	4558 lb.	1259 lb.	
Third . . .	4757 lb.	1268 lb.	
Fourth . .	4223 lb.	1236 lb.	
Total . .			

11. $ 7500 is to be collected for a poor fund; at the beginning of a certain day $ 5225 had already been collected. During the day there were made contributions, as follows: $ 25, $ 15, $ 125, and $ 18. How much more is needed?

12. A dealer lost $ 125 by selling a lot for $ 365. Last year he could have sold it at a profit of $ 50; what was he offered for it last year?

MULTIPLICATION AND DIVISION

Exercise 3

Multiply across; add upward:

1. $45 \times 233 = \bullet$
   $45 \times 418 = \bullet$
   $45 \times 165 = \bullet$
   $45 \times 128 = \bullet$
   $45 \times \ ? \ = \bullet$

2. $67 \times 312 = \bullet$
   $67 \times 183 = \bullet$
   $67 \times 287 = \bullet$
   $67 \times 368 = \bullet$
   $67 \times \ ? \ = \bullet$

3. $89 \times 219 = \bullet$
   $89 \times 326 = \bullet$
   $89 \times 193 = \bullet$
   $89 \times 297 = \bullet$
   $89 \times \ ? \ = \bullet$

4. What number besides 29 will divide 1073?

5. When a certain number is divided by 12, the quotient is 144 and the remainder 5; what is the number?

6. If 75 acres of land cost $3000, what should 12 acres cost at the same price per acre?

7. If the quotient of two numbers is 125 and the divisor is 25, what is the dividend?

8. The number of square miles in Texas is 265,780, and the number in Ireland is 32,360. How many countries the size of Ireland would Texas make, and how many square miles over?

9. If 21 men earn $210 in 5 days, how much does each man earn per day?

10. The following is a good ration for a 1000-lb. cow:

	Ration
Corn silage	30 lb. per day
Red clover hay	16 lb. per day
Corn	6 lb. per day
Cottonseed meal	1 lb. per day

How many pounds of each of the food products given in the ration are required to keep 10 such cows one week?

11. A man bought a farm of 80 acres at $58 an acre and built on it a house at a cost of $3250; he then sold the farm for $9000. What was the profit?

12. Test to see if the following are true:

$$1 \times 8 + 1 = 9$$
$$12 \times 8 + 2 = 98$$
$$123 \times 8 + 3 = 987$$
$$1234 \times 8 + 4 = 9876$$
$$12345 \times 8 + 5 = 98765$$
$$123456 \times 8 + 6 = 987654$$
$$1234567 \times 8 + 7 = 9876543$$
$$12345678 \times 8 + 8 = 98765432$$
$$123456789 \times 8 + 9 = 987654321$$

FACTORS, DIVISORS, AND MULTIPLES

Exercise 4. Review

1. What is meant by the factors of a number?
2. Name two factors of 10; 12; 35; 49; 56.
3. Name three factors of 8; 12; 18; 30; 50.
4. What is a prime number? a composite number?
5. Name the prime factors of 12.
6. Name the prime factors of 20.
7. Name the prime factors of 24.
8. Name all prime numbers that are less than 30.
9. Name the prime numbers between 30 and 40.
10. Name two sets of factors of 12.
11. What is meant by an exact divisor of a number?
12. Name three exact divisors of 12.
13. Name three exact divisors of 20.

14. Name all the exact divisors of 30.

15. What is meant by a common divisor of two or more numbers?

16. Name a common divisor of 15 and 25.

17. Name two common divisors of 20 and 30.

18. Name all the common divisors of 12 and 18.

19. Name a common divisor of 15, 18, and 24.

20. What is meant by the greatest common divisor of two or more numbers?

21. What is the greatest common divisor of 18 and 24?

22. What is the greatest common divisor of 30, 36, and 48?

23. What is meant by a multiple of a number?

24. Name a multiple of 6; 8; 10.

25. What is meant by a common multiple of two or more numbers?

26. Name a common multiple of 6 and 9; 8 and 10.

27. What is meant by the least common multiple of two or more numbers?

28. What is the least common multiple of 4 and 6?

29. What is the least common multiple of 2, 3, and 5?

Divisors

1. An **even** number is a number that is divisible by 2.

2. An **odd** number is a number that is not divisible by 2.

3. Some easy tests of divisibility:

1. A number is divisible by 2 if the units' figure is 0, 2, 4, 6, or 8.

Thus, 68 is divisible by 2, since the units' figure is 8.

2. A number is divisible by 5 if the units' figure is 0, or 5.

Thus, 105 is divisible by 5, since the units' figure is 5.

3. A number is divisible by 4 if the number expressed by the two right-hand figures is divisible by 4.

Thus, 124 is divisible by 4, since 24 is divisible by 4.

4. A number is divisible by 3 if the number expressed by the sum of its digits is divisible by 3.

Thus, 126 is divisible by 3, since $1+2+6$, or 9, is divisible by 3.

5. A number is divisible by 9 if the number expressed by the sum of its digits is divisible by 9.

Thus, 765 is divisible by 9 since $7+6+5$, or 18, is divisible by 9.

4. If a number is divided by one of its prime divisors, the quotient by one of its prime divisors, the next quotient by one of its prime divisors, and so on until the quotient becomes 1, these successive divisors are called the **continued prime divisors** of the number.

3	105
5	35
7	7
	1

Thus, 3, 5, and 7 are the continued prime divisors of 105.

5. The continued prime divisors of a number are the prime factors of the number.

3 | 105	Thus, 3, 5, and 7, the continued prime
5 | 35	divisors of 105, are the prime factors of 105.
7 | 7	For, $105 = 3 \times 35$; and $35 = 5 \times 7$.
1	Therefore, $105 = 3 \times 5 \times 7$.

6. When the prime factors of a number cannot readily be seen, they may be found thus:

2 | 1050	
5 | 525	
5 | 105	
3 | 21	
7	

7. The continued common prime divisors of two or more numbers are their common prime factors.

2	90	120	210	Thus, 2, 5, and 3, the continued
5	45	60	105	common prime divisors of 90, 120,
3	9	12	21	and 210, are the common prime
	3	4	7	factors of 90, 120, and 210.

8. Any of the common prime factors of two or more numbers, or the product of any two or more of such factors, is a common divisor of the numbers.

Thus, in Section 7, the common prime factors of 90, 120, and 210 are seen to be 2, 5, and 3. Hence 90, 120, and 210 are each divisible by 2, 5, 3, 2×5, 2×3, 5×3, and $2 \times 5 \times 3$.

9. The product of all the common prime factors of two or more numbers is their greatest common divisor.

Thus, the greatest common divisor of 90, 120, and 210 is $2 \times 5 \times 3$.

10. The greatest common divisor of two or more numbers may be found thus:

2	294	378	462
3	147	189	231
7	49	63	77
	7	9	11

2, 3, and 7 are the common prime factors of 294, 378, and 462, since they are the continued common prime divisors of them.

Therefore, $2 \times 3 \times 7$, or 42, is the greatest common divisor of 294, 378, and 462.

Exercise 5

Find the prime factors of:

1. 156
2. 182
3. 280
4. 630
5. 735
6. 765
7. 1001
8. 3150

Find all the common divisors of:

9. 30, 42, and 56.
10. 50, 70, and 110.
11. 60, 105, and 120.
12. 66, 88, and 110.
13. 60, 90, and 210.
14. 140, 210, and 350.

Find the greatest common divisor of:

15. 56 and 72.
16. 70 and 98.
17. 63 and 91.
18. 90 and 108.
19. 75 and 175.
20. 112 and 168.
21. 42, 49, and 56.
22. 40, 56, and 72.
23. 70, 80, and 90.
24. 52, 78, and 104.
25. 245, 280, and 315.
26. 288, 384, and 528.
27. 432, 540, and 648.
28. 384, 576, and 768.

In Examples 1–14:

29. Name the numbers that are even.
30. Name the numbers that are odd.

31. Name the numbers that are divisible by 2.
32. Name the numbers that are divisible by 5.
33. Name the numbers that are divisible by 4.
34. Name the numbers that are divisible by 3.
35. Name the numbers that are divisible by 9.

Multiples

11. The least common multiple of two or more numbers may be found thus:

$60 = 2 \times 2 \times 3 \times 5$
$90 = 2 \times 3 \times 5 \times 3$
$210 = 2 \times 3 \times 5 \times 7$

The least common multiple of 60, 90, and 210 must contain the prime factors 2, 2, 3, and 5 in order to contain 60; it must contain the additional prime factor 3, in order to contain 90, and the additional prime factor 7, in order to contain 210.

Therefore, $2 \times 2 \times 3 \times 5 \times 3 \times 7$, or $1260 =$ l. c. m. of 60, 90, and 210.

The least common multiple of two or more numbers is the product of all their different prime factors each taken the greatest number of times it occurs in any one of them.

Exercise 6

Find the least common multiple of:

1. 28 and 42.
2. 84 and 96.
3. 63 and 84.
4. 66 and 99.
5. 56 and 120.
6. 75 and 125.
7. 52 and 130.
8. 105 and 135.
9. 154 and 242.
10. 45, 75, and 90.
11. 52, 78, and 104.
12. 30, 90, and 150.
13. 56, 70, and 84.
14. 110, 275, and 605
15. 65, 91, and 143.
16. 91, 117, and 130.
17. 108, 180, and 243.

REVIEW

Exercise 7

1. The distance from New York to Cincinnati is 752 miles, and from New York to Boston is 233 miles; how much nearer to New York is Boston than Cincinnati?

2. In 1861 the United States produced 3,606,006 bales of cotton. In 1911 it produced 13,873,423. What was the increase for the 50 years?

3. A farmer exchanged 3 dozen eggs at 25¢ a dozen for 5 lb. of meat; how much was the meat per pound?

4. If 4 men do a piece of work in 12 days, how many men should do it in 8 days?

5. How much change should be received from a $2 bill given in payment for 12 oranges at 3¢ apiece?

6. The product of three numbers is 60. If one of them is 3, and another is 4, what is the third?

7. If a girl pastes 12 samples on a card and finishes 60 cards in a day, how many samples can she paste in a day? In how many days can she paste 1440 samples?

8. Find the total length of the swaths 12 in. wide and each 80 ft. long that a lawn 40 ft. wide and 80 ft. long will make.

9. By selling a lot for $520 I lose $50; what would I have gained had I sold it for $630?

10. What number besides 23 will divide 2231 without a remainder?

11. 5 men have equal interest in a tract of 500 acres of land which is sold at \$30 an acre; how much should each receive from the sale, after paying an agent \$ 200 for selling the tract?

12. State which of the numbers 2, 3, 4, and 5 will divide 210.

13. The first railroad in the United States was built in 1831; how long is it since that time?

14. If a man's carfare is 15¢ daily, how much is it in a year of 365 da.?

15. Find the sum of $1\frac{1}{2}$ million and 1 hundred thousand.

16. How many \$ 1000 bills make 1 million dollars?

17. Counting at the rate of \$ 100 per minute, how many minutes would be required, counting continuously, to count \$ 1,000,000 in \$ 1 bills?

18. Find by cancellation the value of $\frac{144 \times 60}{15 \times 24}$.

19. How many sheep at \$ 5 per head should be given in exchange for 3 cows at \$ 50 a head?

20. If I gave in payment for the following purchases a \$ 2 bill, a quarter, a dime, and two nickels, how much change should I receive?

Bill

4 lb. of butter at \$ 0.32 = \$
2 lb. of cheese at \$ 0.16 = \$
3 doz. eggs at \$ 0.23 = \$
1 qt. of molasses at \$ 0.12 = \$
\$

FRACTIONS

REVIEW AND EXTENSION

Exercise 8

1. Read, and tell what each means:

$\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{6}$; $\frac{1}{10}$.

2. Explain what a fractional unit is.

3. Read, and tell what each means:

$\frac{4}{5}$; $\frac{3}{4}$; $\frac{5}{6}$; $\frac{9}{10}$.

4. What is a fraction?

5. What does the denominator of a fraction show? the numerator?

6. What are the numerator and denominator of a fraction called?

7. In the following, name the proper fractions; the improper fractions; the mixed numbers:

$\frac{2}{3}$; $\frac{1}{8}$; $\frac{2}{2}$; $1\frac{1}{2}$; $\frac{8}{9}$; $\frac{9}{8}$; $3\frac{1}{3}$; $\frac{2}{4}$; $\frac{5}{4}$; $\frac{3}{2}$; $2\frac{1}{3}$; $\frac{11}{10}$.

8. What is a proper fraction; an improper fraction; a mixed number?

Reduce to improper fractions [Review the solution of Example 1, Exercise 35, page 51]:

9. $18\frac{3}{4}$ 10. $66\frac{2}{3}$ 11. $50\frac{1}{2}$ 12. $88\frac{1}{8}$

13. $56\frac{3}{4}$ 14. $88\frac{8}{9}$ 15. $70\frac{5}{8}$ 16. $96\frac{7}{8}$

17. $112\frac{1}{2}$ 18. $137\frac{1}{2}$ 19. $133\frac{1}{3}$ 20. $266\frac{2}{3}$

Reduce to whole or mixed numbers [Review the solution of Example 1, Exercise 38, page 53]:

21. $\frac{100}{3}$ 22. $\frac{100}{6}$ 23. $\frac{100}{8}$ 24. $\frac{100}{12}$

25. $\frac{100}{16}$ 26. $\frac{200}{3}$ 27. $\frac{200}{6}$ 28. $\frac{200}{12}$

29. $\frac{300}{16}$ 30. $\frac{300}{32}$ 31. $\frac{500}{16}$ 32. $\frac{600}{16}$

33. When is a fraction in its lowest terms?

34. What is the shortest way of reducing a fraction to its lowest terms?

Reduce to lowest terms:

35. $\frac{180}{195}$ 36. $\frac{144}{124}$ 37. $\frac{270}{288}$ 38. $\frac{162}{168}$

39. $\frac{125}{175}$ 40. $\frac{279}{288}$ 41. $\frac{232}{248}$ 42. $\frac{369}{423}$

43. $\frac{405}{450}$ 44. $\frac{108}{324}$ 45. $\frac{180}{48}$ 46. $\frac{510}{330}$

47. What is the least common denominator of two or more fractions in their lowest terms?

Reduce to fractions having the least common denominator [Review the solution of Example 1, Exercise 42, page 56]:

48. $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{12}$ 49. $\frac{4}{9}$, $\frac{7}{21}$, $\frac{5}{18}$ and $\frac{7}{36}$

50. $\frac{2}{3}$, $\frac{4}{5}$, $\frac{3}{10}$, and $\frac{2}{15}$ 51. $\frac{3}{7}$, $\frac{5}{14}$ and $\frac{2}{28}$

52. $\frac{12}{13}$, $\frac{5}{26}$, and $\frac{4}{39}$ 53. $\frac{9}{15}$, $\frac{8}{20}$ and $\frac{15}{25}$

54. $\frac{8}{63}$ and $\frac{2}{105}$ 55. $\frac{24}{125}$ and $\frac{48}{175}$

56. $\frac{37}{105}$ and $\frac{52}{385}$

57. Tell what is meant by similar fractions. Illustrate.

58. What is the sum of $\frac{3}{8}$, $\frac{1}{8}$, and $\frac{5}{8}$?

59. State how to add two fractions with unlike denominators [Review Section 62, page 58].

Find the sum of:

60. $\frac{2}{15}+\frac{3}{10}+\frac{5}{6}$

61. $\frac{7}{10}+\frac{2}{15}+\frac{2}{3}$

62. $\frac{5}{8}+\frac{7}{12}+\frac{1}{24}$

63. $\frac{2}{5}+\frac{7}{15}+\frac{7}{10}$

64. $\frac{5}{12}+\frac{3}{16}+\frac{5}{24}$

65. $\frac{7}{15}+\frac{8}{9}+\frac{5}{12}$

Add upward; add across:

66.
$\frac{1}{4}+\frac{1}{3}+\frac{1}{2}=?$
$\frac{5}{6}+\frac{2}{3}+\frac{5}{12}=?$
$\frac{1}{2}+\frac{7}{8}+\frac{3}{16}=?$
$? \quad ? \quad ? =?$

67.
$\frac{5}{6}+\frac{7}{8}+\frac{2}{3}=?$
$1\frac{7}{24}+1\frac{9}{48}+\frac{2}{3}=?$
$\frac{1}{36}+\frac{5}{6}+\frac{1}{2}=?$
$? \quad ? \quad ?=?$

68. State how to subtract two similar fractions.

69. What is the difference between $\frac{7}{8}$ and $\frac{3}{8}$?

70. State how to subtract two fractions with unlike denominators [Review Section 65, page 61].

Subtract:

71. $\frac{1}{12}-\frac{1}{15}$

72. $\frac{1}{20}-\frac{1}{30}$

73. $1\frac{3}{15}-\frac{6}{25}$

74. $1\frac{7}{18}-\frac{5}{24}$

75. $\frac{7}{15}-\frac{7}{20}$

76. $\frac{9}{20}-\frac{9}{25}$

77. $\frac{1}{30}-\frac{1}{35}$

78. $\frac{1}{8}-\frac{1}{12}$

79. $\frac{8}{9}-\frac{7}{12}$

80. $\frac{6}{7}-\frac{9}{35}$

81. $\frac{3}{10}-\frac{3}{11}$

82. $2\frac{3}{24}-\frac{5}{16}$

Find the value of:

83. $\frac{3}{4}+\frac{5}{6}-\frac{7}{8}$ 84. $\frac{5}{3}-\frac{5}{9}+\frac{5}{6}$ 85. $1-(\frac{3}{26}+\frac{5}{13})$

86. $\frac{5}{8}+\frac{9}{16}-\frac{7}{24}$ 87. $\frac{4}{5}-\frac{7}{10}+\frac{3}{40}$ 88. $\frac{7}{8}-(\frac{4}{5}-\frac{2}{3})$

Add [Review Section 67, page 64]:

89. $18\frac{3}{4}$, $56\frac{7}{8}$, $19\frac{3}{16}$, $7\frac{1}{2}$

90. $17\frac{4}{5}$, $26\frac{3}{10}$, $5\frac{7}{15}$, $19\frac{2}{3}$

91. $33\frac{1}{3}$, $16\frac{2}{3}$, $22\frac{2}{9}$, $4\frac{1}{6}$

92. $42\frac{9}{16}$, $7\frac{7}{12}$, $13\frac{5}{24}$, $9\frac{2}{3}$

Add upward; subtract across:

93. $100 - 66\frac{2}{3} = ?$
$88\frac{8}{9} - 16\frac{2}{3} = ?$
$33\frac{1}{3} - 6\frac{1}{6} = ?$
$20 - 8\frac{1}{3} = ?$
$? - ? = ?$

94. $50 - 6\frac{1}{4} = ?$
$100 - 16\frac{1}{4} = ?$
$87\frac{1}{2} - 6\frac{1}{4} = ?$
$133\frac{1}{3} - 8\frac{1}{3} = ?$
$? - ? = ?$

95. State how to multiply a fraction by a whole number [Review Section 68, page 69].

Name at sight the product:

96. $2 \times \frac{2}{9}$ 97. $3 \times \frac{7}{9}$ 98. $4 \times \frac{5}{16}$

99. $5 \times \frac{3}{25}$ 100. $5 \times \frac{7}{10}$ 101. $5 \times \frac{10}{3}$

102. State how to multiply a mixed number by a whole number [Review Section 69, page 71].

Multiply at sight:

103. $2 \times 3\frac{2}{5}$ 104. $2 \times 3\frac{2}{7}$ 105. $2 \times 2\frac{3}{8}$

106. $3 \times 2\frac{1}{9}$ 107. $3 \times 2\frac{1}{2}$ 108. $3 \times 2\frac{5}{6}$

109. What is a short way of multiplying a whole number by a fraction [Review Section 70, page 73]?

Name at sight the products:

110. $\frac{3}{4} \times 3$ 111. $\frac{3}{4} \times 4$ 112. $\frac{3}{8} \times 5$

113. $\frac{3}{10} \times 5$ 114. $\frac{3}{8} \times 8$ 115. $\frac{7}{6} \times 6$

116. State how to find the product of two fractions [Review Section 71, page 73].

Name at sight the products:

117. $\frac{1}{2} \times \frac{1}{3}$ 118. $\frac{1}{5} \times \frac{2}{3}$ 119. $\frac{2}{3} \times \frac{2}{5}$ 120. $\frac{2}{3} \times \frac{3}{5}$

121. $\frac{3}{5} \times \frac{5}{3}$ 122. $\frac{5}{4} \times \frac{4}{9}$ 123. $\frac{3}{8} \times \frac{4}{5}$ 124. $\frac{5}{6} \times \frac{18}{25}$

Multiply, expressing the answer in the simplest form [Review Section 72, page 74]:

125. $\frac{14}{15} \times \frac{25}{21}$ 126. $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5}$ 127. $\frac{12}{25} \times \frac{35}{36} \times \frac{8}{9}$

128. $\frac{20}{21} \times \frac{14}{15}$ 129. $\frac{3}{8} \times \frac{16}{15} \times \frac{5}{4}$ 130. $\frac{7}{16} \times \frac{32}{49} \times \frac{7}{8}$

Multiply [Review Section 73, pages 75 and 76]:

131. $58 \times 26\frac{1}{4}$ 132. $98 \times 32\frac{1}{3}$ 133. $98 \times 38\frac{3}{4}$ 134. $76 \times 52\frac{2}{3}$

135. $216\frac{2}{3} \times 33\frac{1}{3}$ 136. $128\frac{5}{6} \times 54\frac{2}{3}$ 137. $132\frac{1}{4} \times 29\frac{1}{3}$ 138. $296\frac{3}{8} \times 35\frac{2}{3}$

139. State two ways of dividing a fraction by a whole number [Review Section 74, page 80].

Divide at sight:

140. $\frac{4}{5} \div 2$ 141. $\frac{8}{3} \div 4$ 142. $\frac{2}{3} \div 5$ 143. $\frac{2}{3} \div 6$

144. $\frac{7}{8} \div 5$ 145. $\frac{3}{5} \div 5$ 146. $\frac{10}{3} \div 5$ 147. $\frac{10}{3} \div 3$

148. State how to find the quotient of 1 divided by a fractional unit [Review Section 75, page 82].

149. Name at sight the quotients:

$$1 \div \tfrac{1}{3};\quad 1 \div \tfrac{1}{6};\quad 1 \div \tfrac{1}{10};\quad 1 \div \tfrac{1}{12}.$$

150. State how to find the quotient of any whole number divided by a fractional unit [Review Section 76, page 82].

151. Name at sight the quotients:

$$3 \div \tfrac{1}{6};\quad 3 \div \tfrac{1}{8};\quad 5 \div \tfrac{1}{5};\quad 7 \div \tfrac{1}{10}.$$

152. When is one fraction said to be the inverse of another?

153. What is the inverse of:

$$\tfrac{2}{3}?\quad \tfrac{5}{2}?\quad \tfrac{6}{7}?\quad 2?$$

154. Name two fractions that are reciprocals.

155. State how to find the quotient of 1 divided by any fraction [Review Section 77, page 83].

156. Name at sight the quotients:

$$1 \div \tfrac{5}{6};\quad 1 \div \tfrac{9}{10};\quad 1 \div \tfrac{5}{2};\quad 1 \div \tfrac{7}{3}.$$

157. State how to divide any whole number by a fraction [Review Section 78, page 84].

158. Name at sight the quotients:

$$2 \div \tfrac{3}{5};\ 3 \div \tfrac{3}{4};\ 5 \div \tfrac{10}{3};\ 4 \div \tfrac{4}{5};$$
$$2 \div 1\tfrac{1}{2};\quad 3 \div 1\tfrac{1}{3};\quad 4 \div 1\tfrac{1}{4};\quad 2 \div 1\tfrac{1}{5}.$$

159. State how to divide a fraction by a fraction. State how to divide any number by a fraction [Review Sections 79 and 80, pages 84 and 85].

Divide:

160. $\frac{9}{10} \div \frac{27}{25}$ 161. $75 \div \frac{3}{4}$ 162. $9 \div \frac{7}{15}$

163. $\frac{15}{16} \div \frac{24}{35}$ 164. $100 \div \frac{25}{2}$ 165. $100 \div \frac{100}{3}$

Divide [Review Section 82, page 86]:

166. $275\frac{2}{3} \div 16\frac{2}{3}$ 167. $337\frac{1}{2} \div 16\frac{1}{4}$

168. $555\frac{5}{9} \div 66\frac{2}{3}$ 169. $666\frac{2}{3} \div 77\frac{7}{9}$

170. 12 is $\frac{4}{5}$ of what number?

171. 15 is $\frac{3}{2}$ of what number?

172. $\frac{3}{4}$ of a number is 21; what is the number?

173. What part of 5 is 4? What part of 5 is 3?

174. What part of 5 is $\frac{1}{3}$? What part of 5 is $\frac{2}{3}$?

175. What part of $\frac{1}{2}$ is $\frac{1}{8}$? What part of $1\frac{1}{2}$ is $\frac{3}{4}$?

176. A laborer who is hired for $240 per year, should be paid how much for 5 months?

177. A lady who charges $1\frac{3}{4}$ a day for board should charge how much for 15 days' board?

178. When coal costs $5 a ton, what part of a ton can be bought for $1? $2\frac{1}{2}$? $1\frac{1}{4}$?

179. How many yards of cloth can be bought for $2\frac{1}{2}$ at $\frac{1}{2}$ a yard?

180. If 4 lb. of spices were put up in 16 equal packages, what was the weight of each package?

181. Where eggs are selling at 30¢ a dozen, what is the price per score?

182. What is the distance around a tree if a string $1\frac{7}{8}$ yards long will reach three times around it?

183. A lady paid 6 cents for $\frac{3}{4}$ of a yard of muslin; what was the price per yard?

184. If 96 bu. of potatoes were raised on $\frac{3}{4}$ of an acre, at the same rate how many bushels could be raised on an acre?

185. If $\frac{3}{4}$ of a bushel of oats weighs 24 pounds, what does a bushel weigh?

186. After spending 12 cents, a boy finds he has spent $\frac{6}{7}$ of his money; how much money had he?

187. A man, after walking 8 miles, finds he has yet $\frac{5}{9}$ of his journey to go; how long is his journey?

188. If the distance around a carriage wheel is $7\frac{1}{2}$ feet, how many times has it turned in going 1 mile, or 5280 feet?

189. A cubic foot of water weighs $62\frac{1}{2}$ lb.; how many cubic feet of water are there in a ton of 2000 lb.?

190. If the cloth for a suit costs $\$15\frac{3}{4}$ at $\$2\frac{1}{4}$ a yard, how many yards were bought for the suit?

191. How many pounds of lard at $11\frac{1}{4}$¢ a pound can be bought for 6 dozen of eggs at $12\frac{1}{2}$¢ a dozen?

192. How many times can a bucket holding $2\frac{1}{4}$ gallons be filled from a barrel holding $31\frac{1}{2}$ gallons?

193. I bought $2\frac{1}{2}$ dozen of eggs at 30 cents a dozen and $\frac{3}{4}$ of a pound of dried beef at 24 cents a pound; what was my bill?

194. If $3\frac{1}{2}$ yards of ribbon are cut into pieces $\frac{1}{4}$ of a yard long, how many pieces are made?

195. If 2 lb. of cheese can be bought for $\frac{1}{4}$ of a dollar, for how many pounds should $\frac{7}{8}$ of a dollar be charged?

196. A quart of milk weighs about $2\frac{1}{2}$ pounds; how many quarts are there in 100 pounds?

197. How long will $4\frac{3}{4}$ bushels of oats last a horse which is fed $\frac{3}{4}$ of a bushel a day?

198. A owned $\frac{2}{3}$ of an acre of land and sold $\frac{3}{4}$ of it; what part of an acre had he then?

199. Black tea forms $\frac{2}{5}$ of a mixture of black and green tea. There are $2\frac{1}{4}$ pounds of green tea in the mixture; what is the weight of the mixture?

200. From an acre on which $2\frac{1}{2}$ bushels of seed were sown, the yield is 20 bushels; what is the yield from each bushel of seed?

201. A merchant paid 4 times as much for a pound of coffee as for a pound of sugar, and for both he paid $31\frac{1}{4}$ cents; find the cost of each per pound.

202. $\frac{2}{7}$ of the weight of a bushel of corn equals $\frac{1}{2}$ of the weight of a bushel of oats, and the difference of their weights is 24 pounds; find the weight of a bushel of each.

203. A dealer bought an article for $20 and sold it at a gain of $\frac{2}{5}$ of the cost; find the selling price.

204. The gain made in selling a pair of shoes was $1\frac{2}{5}$; if this was $\frac{7}{20}$ of the cost, what was the selling price?

205. One pipe can carry off the water in a tank in 6 hours, and another pipe in 4 hours; what part of it can both together carry off in an hour?

206. There are 2000 pounds in a short ton, which is $\frac{25}{28}$ as heavy as a long ton; how many pounds are there in a long ton?

207. At $15\frac{3}{5}$ a ton, find the cost of $12\frac{1}{2}$ tons of hay.

208. A bankrupt's property is $3000, and with it he can pay $\frac{2}{3}$ of his debts; what are his debts?

209. A farmer raised $286\frac{2}{3}$ bushels of wheat on $14\frac{1}{3}$ acres; what was the yield per acre?

210. Find the value of $\frac{8}{9} \times \frac{3}{4} + \frac{1}{3} + \frac{1}{4} \times 2\frac{1}{2} - 1\frac{1}{4}$.

211. $\frac{3}{4}$ of a number was diminished by 10 and then there remained $\frac{7}{12}$ of the number; find the number.

212. Express in words $\frac{3}{6}\frac{0}{2}\frac{4}{2}$.

213. 60 pounds of good wheat produce about $43\frac{5}{9}$ pounds of flour; how many pounds of wheat will produce a barrel of 196 pounds of flour?

214. From a piece of cloth containing 24 yards there were sold $2\frac{1}{2}$ yards, $3\frac{3}{4}$ yards, and $12\frac{1}{8}$ yards. Find the value of the remainder at $1\frac{1}{3}$ a yard.

215. A laborer who earns $1\frac{2}{3}$ a day spends $\frac{3}{4}$ of a dollar a day for support and saves the remainder. If he

has already saved $\$24\frac{1}{4}$, how many days more must he work to save his rent, which is \$60?

216. A merchant sold \$15 worth of potatoes at $\$\frac{3}{4}$ a bushel, thereby making a profit of \$5. What did he pay for them per bushel?

217. What part of a gallon is $2\frac{1}{2}$ qt.?

218. The sum of three numbers is 100. If the first is $37\frac{1}{2}$, and the second is $12\frac{1}{2}$ more than the first, what is the third?

219. At $\$33\frac{1}{3}$ per month, in how many years would the rent of a house amount to its value, which is estimated at \$4000?

220. If a man's income is \$1500 for a year and his expenses are \$875, what are his average savings per month for that year?

221. A dealer bought 200 bu. of clover seed at $\$9\frac{1}{2}$ per bushel, and sold it at a profit of \$300; what did he receive for it per bushel?

222. Find a grocer's gain on 100 lb. of sugar bought at $5\frac{3}{8}¢$ per pound and sold at $6¢$ per pound.

223. A tank weighing 635 lb. and holding 700 gal. is full of water. Find the combined weight, water weighing about $8\frac{1}{3}$ lb. per gallon.

224. A man receives $\$\frac{2}{5}$ an hour, and works during the six working days of a certain week as follows: $7\frac{1}{2}$ hrs., $8\frac{1}{2}$ hrs., 10 hrs., $12\frac{1}{2}$ hrs., 9 hrs., 8 hrs. How much does he receive that week?

COMPLEX FRACTIONS

12. A **complex fraction** is an expression in the form of a fraction, one or both of whose terms are either fractions or mixed numbers.

Thus, $\frac{\frac{3}{4}}{2}$, $\frac{2}{\frac{3}{4}}$, $\frac{\frac{2}{3}}{\frac{4}{4}}$, and $\frac{2\frac{1}{2}}{3\frac{1}{5}}$ are complex fractions.

NOTE. — A complex fraction may be regarded as denoting that the numerator is to be divided by the denominator.

Exercise 9

1. Reduce $\frac{\frac{3}{4}}{2}$ to a simple fraction.

SOLUTION. — $\frac{\frac{3}{4}}{2} = \frac{3}{4 \times 2}$ [§ 74, p. 80] $= \frac{3}{8}$.

2. Reduce $\frac{2}{\frac{3}{4}}$ to a simple fraction.

SOLUTION. — $\frac{2}{\frac{3}{4}} = \frac{4}{3}$ of 2 [§ 78, p. 84] $= \frac{8}{3}$, or $2\frac{2}{3}$.

3. Reduce $\frac{\frac{2}{3}}{\frac{3}{4}}$ to a simple fraction.

SOLUTION. — $\frac{\frac{2}{3}}{\frac{3}{4}} = \frac{2}{3} \div \frac{3}{4} = \frac{4}{3} \times \frac{2}{3} = \frac{8}{9}$.

4. Reduce $\frac{2\frac{1}{2}}{3\frac{1}{3}}$ to a simple fraction.

SOLUTION. — $\frac{2\frac{1}{2}}{3\frac{1}{3}} = \frac{\frac{5}{2}}{\frac{10}{3}} = \frac{3}{10} \times \frac{5}{2} = \frac{3}{4}$.

5. Reduce $\frac{3\frac{1}{5} - 2\frac{1}{2}}{3\frac{1}{4} + 1\frac{1}{2}}$ to a simple fraction.

SOLUTION. — $\frac{3\frac{1}{5} - 2\frac{1}{2}}{3\frac{1}{4} + 1\frac{1}{2}} = \frac{20(3\frac{1}{5} - 2\frac{1}{2})}{20(3\frac{1}{4} + 1\frac{1}{2})} = \frac{64 - 50}{65 + 30} = \frac{14}{95}$.

Reduce to simple fractions:

6. $\dfrac{\frac{4}{5}}{2}$ 7. $\dfrac{\frac{10}{3}}{8}$ 8. $\dfrac{4}{\frac{8}{3}}$

9. $\dfrac{5}{\frac{9}{20}}$ 10. $\dfrac{10\frac{5}{12}}{5}$ 11. $\dfrac{3\frac{1}{3}}{10}$

12. $\dfrac{100}{16\frac{2}{3}}$ 13. $\dfrac{50}{33\frac{1}{3}}$ 14. $\dfrac{\frac{4}{5}}{\frac{7}{8}}$

15. $\dfrac{12\frac{1}{2}}{\frac{3}{8}}$ 16. $\dfrac{\frac{7}{8}}{62\frac{1}{2}}$ 17. $\dfrac{12\frac{1}{2}}{6\frac{1}{4}}$

18. $\dfrac{16\frac{2}{3}}{83\frac{1}{3}}$ 19. $\dfrac{37\frac{1}{2}}{87\frac{1}{2}}$ 20. $\dfrac{14\frac{2}{7}}{71\frac{3}{7}}$

21. $\dfrac{66\frac{2}{3}}{4\frac{1}{6}}$ 22. $\dfrac{2+\frac{2}{3}}{2-\frac{2}{3}}$ 23. $\dfrac{4+2\frac{1}{12}}{5-1\frac{5}{6}}$

24. $\dfrac{\frac{8}{9}-\frac{2}{3}}{\frac{5}{9}-\frac{1}{3}}$ 25. $\dfrac{5\frac{3}{4}-\frac{2}{3}}{3\frac{1}{4}+\frac{1}{12}}$ 26. $\dfrac{12\frac{1}{2}+6\frac{1}{4}}{18\frac{3}{4}-3\frac{1}{8}}$

27. $\dfrac{\frac{3}{100}+\frac{9}{50}+\frac{4}{25}+\frac{3}{5}}{\frac{92}{100}-\frac{23}{50}+\frac{12}{25}-\frac{16}{25}}$ 28. $\dfrac{\frac{3-\frac{1}{5}}{4}-\frac{3+\frac{1}{5}}{8}}{16}$

29. $\dfrac{(\frac{2}{3}+\frac{3}{4})\times(\frac{3}{4}-\frac{2}{3})}{(\frac{9}{16}-\frac{4}{9})\div(\frac{2}{3}+\frac{3}{4})}$ 30. $\dfrac{\frac{2}{3}\times\frac{3}{4}}{\frac{1}{4}\div\frac{1}{2}}$

31. $\dfrac{12\frac{1}{2}+37\frac{1}{2}}{50\div100}$ 32. $\dfrac{87\frac{1}{2}+12\frac{1}{2}}{\frac{1}{2}\times\frac{1}{4}\div\frac{1}{8}}$

33. $\dfrac{16\frac{2}{3}\times\frac{1}{10}\times\frac{1}{2}}{1\div\frac{1}{2}}$ 34. $\dfrac{\frac{5}{6}\text{ of }\frac{2}{5}\div5}{\frac{1}{2}+\frac{2}{5}}$

35. $\dfrac{(\frac{1}{2}+\frac{1}{4})-(\frac{1}{2}\text{ of }\frac{1}{4})}{2\frac{1}{2}+1\frac{1}{4}}$ 36. $\dfrac{\frac{1}{2}\text{ of }\frac{1}{4}\div\frac{1}{8}+2\frac{1}{2}\div5}{2\frac{1}{2}\div5}$

DECIMALS

READING AND WRITING DECIMALS

13. Decimal fractions may be written without a denominator. A figure written in the first place to the right of the decimal point expresses *tenths;* in the second place, *hundredths;* in the third place, *thousandths;* in the fourth place, *ten-thousandths;* in the fifth place, *hundred-thousandths;* in the sixth place, *millionths.*

14. **Table**

Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
5	3	8	7	4	2	3	.	2	3	5	6	4	8

Reading and Writing Decimals of One Order

Exercise 10

1. Name the first place to the right of the decimal point; the second; the fourth; the fifth; the third; the sixth.

2. Beginning at the decimal point, name the decimal places in their order to millionths.

3. Begin at the right, name the places to the left of the decimal point.

4. Counting from the decimal point, what is the number of the tenths' place? the hundred-thousandths'? the thousandths'? the millionths'? the hundredths'? the ten-thousandths'?

5. In the number written in the table, page 185, how many tenths are there? how many thousandths? how many hundred-thousandths? how many tens? how many hundreds? how many thousands? how many millionths? how many millions?

Exercise 11

Read:

1. .01; .0001; .1; .00001; .001; .000001
2. .02; .003; .0004; .5; .000007; .000009
3. .006; .7; .09; .0006; .000008; .000007
4. .3; .007; .08; .0005; .000002

Exercise 12

Write in words:

1. .01, also .1
2. .001, also .00001
3. .0001, also .000001
4. .2, also .002
5. .0007, also .08
6. .00009, also .006
7. .02, also .0004
8. .007, also .00005

Write as decimals:

9. $\frac{1}{100}$; $\frac{2}{10}$; $\frac{3}{1000}$
10. $\frac{7}{10}$; $\frac{6}{10000}$; $\frac{7}{100000}$
11. $\frac{3}{100}$; $\frac{6}{10000}$; $\frac{4}{1000000}$
12. $\frac{6}{10}$; $\frac{5}{1000}$; $\frac{6}{100}$
13. $\frac{4}{1000}$; $\frac{6}{1000000}$; $\frac{4}{10}$
14. $\frac{7}{100}$; $\frac{8}{1000}$; $\frac{9}{100000}$

Exercise 13

Reading and Writing Decimals of more than One Order

[Review Section 87, page 100.]

Read:

1. .25	2. .37	3. .752
4. .082	5. .030	6. .201
7. .0028	8. .0325	9. .7248
10. .2004	11. .30014	12. .00154
13. .00302	14. .403	15. 7.24
16. .000204	17. 12.5	18. 13.07
19. 28.375	20. 36.004	21. 200.02

15. $.02\frac{1}{4}$ is read *two and one fourth hundredths;* and $3.12\frac{1}{2}$ is read *three and twelve and one half hundredths.*

Exercise 14

Read:

1. $.06\frac{1}{4}$	2. $.12\frac{1}{2}$	3. $.37\frac{1}{2}$	4. $.62\frac{1}{2}$
5. $.87\frac{1}{2}$	6. $.16\frac{2}{3}$	7. $.08\frac{1}{3}$	8. $.037\frac{1}{2}$
9. $.33\frac{1}{3}$	10. $6.66\frac{2}{3}$	11. $4.18\frac{3}{4}$	12. $5.07\frac{1}{2}$

Exercise 15

Write in decimal form:

1. $\frac{36}{100}$	2. $\frac{45}{100}$	3. $\frac{36}{10000}$	4. $\frac{58}{1000}$
5. $\frac{56}{100000}$	6. $\frac{88}{1000000}$	7. $\frac{16}{100}$	8. $\frac{25}{1000}$
9. $\frac{325}{1000}$	10. $3\frac{50}{100}$	11. $7\frac{90}{100}$	12. $8\frac{75}{1000}$

13. 18 hundredths
14. 15 ten-thousandths
15. 25 thousandths
16. 607 thousandths
17. 19 millionths
18. 185 hundred-thousandths
19. 325 ten-thousandths
20. Twenty-eight hundredths
21. Six and twenty-one thousandths
22. Two hundred four millionths
23. Twenty and seven tenths
24. Two hundred six thousandths
25. Two hundred and six thousandths

SUGGESTION. — Two hundred is an integer.

Reading Decimals Approximately

Exercise 16

1. Tell for what amount of money each figure stands in $764.326.
2. Is 6 mills more or less than half a cent?
3. Which is $0.326 nearer, $0.33 or $0.32?
4. Read $764.326 correct to the nearest cent.
5. Which is $0.326 nearer, $0.30 or $0.40?
6. Read $764.326 correct to the nearest dime.
7. Which is $764.326 nearer, $764 or $765?
8. Read $764.326 correct to the nearest dollar.

9. Read 6.378 correct to the nearest hundredth.

10. Read 6.378 correct to the nearest tenth.

11. Read 6.378 correct to the nearest unit.

12. Read 2.7838 correct to the nearest thousandth.

13. Read 2.7838 correct to the nearest hundredth.

14. Read 2.4838 correct to the nearest tenth.

15. Read 2.78 correct to the nearest unit.

16. A bill of goods amounted to $12.568; what was the bill, correct to the nearest cent?

17. A bill of goods amounted to $56.124; what was the bill, correct to the nearest cent?

In making settlement, bills are usually paid correct to the nearest cent, an exact half cent being considered a cent.

Name the amounts that should be paid in settling the following bills:

18. $27.486; $8.424; $3.125

19. $5.464; $5.4882; $5.7605

20. $2.0641; $2.0065; $2.1053

REDUCTION

Exercise 17

[Before answering the first two questions review Sections 88 and 89, page 102.]

1. Annexing ciphers to a decimal has what effect on its value?

2. Removing ciphers from the right of a decimal has what effect on its value?

Reduce:

3. .2 to hundredths.
4. .64 to thousandths.
5. .255 to ten-thousandths.
6. .20 to tenths.
7. .240 to hundredths.
8. .5000 to tenths.
9. .2 to thousandths.
10. .04 to thousandths.
11. .005 to millionths.
12. .200 to tenths.
13. .6000 to hundredths.
14. .25 to ten-thousandths.

Reducing Decimals to Common Fractions or Mixed Numbers

16. 1. Reduce .375 to a common fraction.

Thus, $.375 = \frac{375}{1000}$, or $\frac{3}{8}$.

2. Reduce $.16\frac{2}{3}$ to a common fraction.

Thus, $.16\frac{2}{3} = \frac{16\frac{2}{3}}{100} = \frac{3 \times 16\frac{2}{3}}{3 \times 100} = \frac{50}{300}$, or $\frac{1}{6}$.

Exercise 18

Reduce to common fractions or mixed numbers:

1. .6
2. .08
3. .25
4. .004
5. .075
6. .225
7. .450
8. .0025
9. 7.5
10. 1.08
11. 12.012
12. 6.775
13. $.8\frac{1}{3}$
14. $.6\frac{1}{4}$
15. $.12\frac{1}{2}$
16. $.37\frac{1}{2}$
17. $.14\frac{2}{7}$
18. $.33\frac{1}{3}$
19. $.66\frac{2}{3}$
20. $.18\frac{3}{4}$
21. $.87\frac{1}{2}$
22. $.83\frac{1}{3}$
23. $.28\frac{4}{7}$
24. $.42\frac{6}{7}$

Reducing Common Fractions to Decimals

17. Any common fraction may be reduced to a decimal. Thus:

Reduce $\frac{3}{4}$ to a decimal.

$4)\overline{3.00}$
$.75$

$\frac{3}{4}$ equals $\frac{1}{4}$ of 3, which equals $\frac{1}{4}$ of 30 tenths
$\frac{1}{4}$ of 30 tenths is 7 tenths, and 2 tenths remaining.
2 tenths equals 20 hundredths.
$\frac{1}{4}$ of 20 hundredths is 5 hundredths.
Therefore, $\frac{3}{4}$ equals .75.

Hence, to reduce a common fraction to a decimal:

Annex ciphers to the numerator, divide by the denominator, and point off as many decimal places in the quotient as there are ciphers annexed.

18. *In practice reduce thus:*

1. Reduce $\frac{3}{8}$ to a decimal. $8)\overline{3.000}$ $.375$
2. Reduce $\frac{5}{6}$ to hundredths. $6)\overline{5.00}$ $.83\frac{1}{3}$
3. Reduce $\frac{8}{9}$ to thousandths. $9)\overline{8.000}$ $.888\frac{8}{9}$

Exercise 19

Reduce to decimals:

1. $\frac{1}{2}$	2. $\frac{1}{5}$	3. $\frac{3}{5}$	4. $\frac{3}{8}$
5. $\frac{5}{8}$	6. $\frac{1}{8}$	7. $\frac{3}{16}$	8. $\frac{7}{8}$
9. $\frac{3}{25}$	10. $\frac{7}{20}$	11. $\frac{5}{16}$	12. $\frac{3}{75}$
13. $\frac{9}{40}$	14. $\frac{3}{50}$	15. $\frac{1}{200}$	16. $\frac{3}{80}$

Reduce:

17. $\frac{1}{6}$ to tenths.
18. $\frac{2}{9}$ to hundredths.
19. $\frac{7}{12}$ to hundredths.
20. $\frac{5}{12}$ to thousandths.

ADDITION AND SUBTRACTION

Exercise 20

Add each in one minute or less:

1.	2.	3.	4.
.4127	.9118	1.3407	27.4348
.8562	.7456	4.7321	14.8653
.3791	.3984	3.9456	86.9720
.5314	.6798	6.1684	29.5438
.1746	.7436	8.1215	32.2936
.1942	.5679	5.2019	64.4875
.1179	.9786	2.4788	53.5396

5.	6.	7.	8.
98.4416	38.1729	77.5888	6.0001
10.1	59.6743	.7	89
6.76	20.2	46	.8
75.243	.9236	96.4711	29.44
61.13	9.6438	.108	1.263
40.0007	.7491	2.3	7.7
66.6699	43.24	.678	76.4328

Subtract:

9.	10.	11.	12.
.2956	.7890	.9481	.8541
.1432	.5421	.9409	.6897

13.	14.	15.	16.
1.4687	9.7648	21.4262	80
1.2345	8.8059	19.8371	79.4387

Exercise 21

1. Henry had \$6.50; he owed \$3.85. How much will he have left after paying the bill?

2. A girl buys a hat for \$5.50 and a pair of gloves for \$1.25; how much change should she receive if she gave in payment a \$10 bill?

3. Which is nearer to \$10 and by how much, \$9.37 or \$10.79?

4. The distance from Ardmore to Frazer is 15.4 mi., from Frazer to Coatesville 14.6 mi., and from Coatesville to Harrisburg 65.3 mi. What is the distance from Ardmore to Harrisburg by this route?

5. A man paid for his house in 3 payments; the first was \$350.50, the second \$750.25, and the third \$560.75. What did the house cost?

6. How much greater is 1 than .3875?

7. What decimal added to .3756 will make the sum .4?

8. $(.04+.005)-(.04-.005)=?$

9. What is the area of Greater New York, which is composed of the following boroughs, with the area of each as here given:

Manhattan	21.93 sq. mi.
Brooklyn	77.62 sq. mi.
The Bronx	40.65 sq. mi.
Queens	129.50 sq. mi.
Richmond	57.19 sq. mi.

How much larger is Brooklyn than The Bronx?

10. Here is a kitchen outfit arranged by a large department store. Find the total cost.

Two-burner Gas Stove	$1.35	Sugar Dredger	$ .15
Wash Tub	1.25	Flour Dredger	.15
Wash Board	.35	Salt Dredger	.05
Clothes Wringer, 1-year Guarantee	3.50	Pepper Dredger	.05
Clothes Line, 75 feet	.40	Grater	.08
Ironing Board, 4 feet	.65	Bread Toaster	.10
Step ladder, 3 feet	.54	Egg Beater	.10
Salt Box	.25	Cake Turner	.10
Rolling Pin	.15	Tin Colander	.27
Meat Board	.20	Tin Dipper	.10
Potato Masher	.18	Tin Gem Pan	.15
Flour Bucket	.35	Strainer	.10
Soap Cup	.12	Funnel	.05
Slaw Cutter	.30	Pie Pans, three	.21
Kitchen Table, 36 inches	1.50	Jelly Cake Pans, two	.20
Clothes Pins, 5 dozen	.15	Agate Cooking Pot, 4 quarts	.58
Clothes Basket	1.30	Agate Lipped Sauce Pan, 2 quarts	.30
Galvanized Coal Bucket	.35	Agate Teakettle, 5 quarts	1.00
Galvanized Water Pail, 12 quarts	.25	Agate Coffeepot, 2 quarts	.60
Griddle, Iron	.40	Agate Teapot, 1 quart	.50
Frying Pan, Iron	.35	Broom	.45
Roasting Pan	.50	Dust Brush	.45
Bread Raiser	.65	Floor Sweeping Brush	1.00
Bread Box	.65	Scrubbing Brush	.12
Sugar Can	.60	Food Chopper	.75
Coffee Canister, 1 pound	.25	Kitchen Knife	.50
Tea Canister, ½ pound	.20	Paring Knife	.15
		Total	

MULTIPLICATION AND DIVISION

Multiplying by Integers and by Decimals

19. 1. $3 \times .4 = 1.2$ [Review Section 93, page 108].

2. $.4 \times 2 = \frac{4}{10} \times 2 = \frac{8}{10} = .8$

3. $.4 \times .6 = \frac{4}{10} \times \frac{6}{10} = \frac{24}{100} = .24$

4. $.3 \times .04 = \frac{3}{10} \times \frac{4}{100} = \frac{12}{1000} = .012$

5. $.05 \times .07 = \frac{5}{100} \times \frac{7}{100} = \frac{35}{10000} = .0035$

6. In Example 1, how many decimal places are there in the multiplicand? How many are there in the multiplier? How many are there in the product?

7. In Example 2, how many decimal places are there in the multiplicand? in the multiplier? in the product?

8. In Example 3, how does the number of decimal places in the multiplicand and multiplier together compare with the number in the product?

9. In each of Examples 4 and 5 compare the number of decimal places in the product with the number in the multiplicand and multiplier together.

20. To multiply decimals, multiply as in whole numbers, and point off as many decimal places in the product as there are in the multiplicand and multiplier together.

21. Multiply .075 by 45; .075 by .45; .000075 by 420.

.075	.075	.000075
45	.45	420
375	375	1500
300	300	300
3.375	.03375	.031500

Exercise 22

Multiply:

1. .25 by 7
2. 3.25 by 5
3. .035 by 9
4. 2.45 by 12
5. .095 by 15
6. .075 by 14
7. 8.36 by 40
8. .375 by 30
9. .508 by 25
10. .0086 by 54
11. 54 by .06
12. 4.8 by 7.8
13. .66 by .06
14. .32 by 20
15. 1.75 by 240
16. .654 by 2500
17. .375 by .0004
18. 100.5 by .25
19. 3.96 by .00256
20. .879 by 7.56

Multiplying and Dividing by 10, 100, 1000, etc.

Exercise 23

Answer the following at sight [Review Section 94, page 110; Section 97, page 112]:

1. $10 \times .05 = \bullet$
2. $10 \times .025 = \bullet$
3. $10 \times .0075 = \bullet$
4. $100 \times .0025 = \bullet$
5. $100 \times 2.85 = \bullet$
6. $100 \times .0001 = \bullet$
7. $10 \times 2.5 = \bullet$
8. $10 \times 2.56 = \bullet$
9. $100 \times .0075 = \bullet$
10. $.5 \div 10 = \bullet$
11. $.05 \div 10 = \bullet$
12. $2.5 \div 10 = \bullet$
13. $.027 \div 10 = \bullet$
14. $8.5 \div 10 = \bullet$

15. $.001 \div 10 = \bullet$
16. $5 \div 10 = \bullet$
17. $1000 \times .075 = \bullet$
18. $1000 \times .758 = \bullet$
19. $1000 \times .001 = \bullet$
20. $100 \times 7.5 = \bullet$
21. $100 \times .0095 = \bullet$
22. $1000 \times .07 = \bullet$
23. $100 \times .5 = \bullet$
24. $1000 \times .7 = \bullet$
25. $10{,}000 \times .0002 = \bullet$
26. $7 \div 1000 = \bullet$
27. $8.4 \div 1000 = \bullet$
28. $75.6 \div 1000 = \bullet$
29. $.01 \div 1000 = \bullet$
30. $25 \div 1000 = \bullet$
31. $.7 \div 1000 = \bullet$
32. $127.5 \div 1000 = \bullet$

Dividing by Integers and by Decimals

Exercise 24

Answer the following at sight [Review Section 95, page 111]:

1. $.5 \div 5$
2. $.8 \div 2$
3. $.05 \div 5$
4. $.25 \div 5$
5. $.34 \div 2$
6. $.6 \div 3$
7. $.048 \div 6$
8. $.36 \div 6$
9. $.24 \div 4$
10. $.4 \div 2$
11. $.117 \div 9$
12. $.220 \div 5$
13. $.420 \div 2$
14. $.16 \div 8$
15. $.9 \div 3$
16. $.240 \div 6$
17. $.450 \div 9$
18. $.630 \div 2$
19. $.33 \div 3$
20. $.50 \div 5$

22. Divide .008 by .04.

$$.008 \div .04 = \frac{8}{1000} \div \frac{4}{100} = \frac{8}{\cancel{1000}\,10} \times \frac{\cancel{100}}{4} = \frac{8}{10} \times \frac{1}{4} = .8 \div 4.$$

That is, $.008 \div .04 = .8 \div 4$.

From this illustration we see that:

Moving the decimal point to the right or to the left the same number of places in both dividend and divisor does not change the quotient.

23. Divide:

(1) .0625 by .25; (2) 6.25 by .0025; (3) 6.25 by 2500

(1) $.25\overline{).0625} = 25\overline{)6.25}$

$$\begin{array}{r} .25 \\ 50 \\ \hline 125 \\ 125 \\ \hline \end{array}$$

(2) $.0025\underline{)\,6.25} = 25\overline{)\,62500}$

$$\begin{array}{r} 2500 \\ 50 \\ \hline 125 \\ 125 \\ \hline 00 \end{array}$$

(3) $2500\underline{)\,6.25} = 25\overline{)\,.0625}$

$$\begin{array}{r} .0025 \\ 50 \\ \hline 125 \\ 125 \\ \hline \end{array}$$

From these illustrations we see that, in division of decimals, we may:

24. Move the decimal point to the right or to the left in both dividend and divisor such a number of places as will make the divisor a whole number not ending in ciphers; then divide and point off in the quotient as many decimal places as there are in the dividend.

Exercise 25

Divide:

1. .025 by .5	2. .075 by .15
3. .16 by .04	4. .036 by .06
5. 1.44 by .02	6. .048 by .12
7. .144 by .012	8. .0375 by .15
9. .1728 by .036	10. 30.75 by .075
11. .02 by .002	12. .5 by .0005
13. .125 by .025	14. 1 by .08
15. 1.44 by .036	16. 86.4 by .24
17. 256 by 200	18. 2.25 by 150
19. .9 by 360	20. 4840 by 16

25. In practice the division is seldom carried beyond the fifth decimal place in the quotient, which is usually expressed to the nearest ten-thousandth.

Thus, if the quotient is .76452+, expressed to the nearest ten-thousandth it is .7645. If the quotient is .76456+, expressed to the nearest ten-thousandth it is .7646.

NOTE. — The sign + in the above illustration indicates that the quotient expressed is not complete.

Exercise 26

Express to the nearest ten-thousandth the value of:

1. $2.573 \div 6$
2. $25.38 \div 8$
3. $.075 \div 6$
4. $37.52 \div 9$
5. $.046 \div .06$
6. $1 \div 15$
7. $.8 \div 11$
8. $325.5 \div 16.5$
9. $\$375.875 \div 15$
10. $\$1000 \div 12$

Exercise 27

1. A gallon of water weighs 8.36 lb.; find the weight of 68 gal. of water.

2. Find the cost of 6.75 yd. of cloth at \$1.25 per yard.

3. A franc is worth 19.3¢; how much are 65 francs worth?

4. A cubic foot of water weighs 62.5 lb. Iron is 7.788 times as heavy as water. What is the weight of a cubic foot of iron?

5. Find the cost of 25.75 A. of land at \$65.50 per acre.

6. Find the weight of a cubic foot of oak, which is 1.17 times as heavy as water (62.5 lb. per cubic foot).

7. A cubic inch of wrought iron weighs .26 lb.; find the weight of a cubic foot of wrought iron.

8. If .75 of a man's crop of wheat is 900 bu., what is his crop?

9. The dressed weight of a steer is estimated to be .60 of its live weight; estimate what was the live weight of a steer whose dressed weight was 570 lb.

10. The dressed weight of a hog is estimated to be .80 of its live weight; estimate what was the live weight of a hog whose dressed weight was 142 lb.

11. If a hack driver receives $1.75 a day, in how many days will he earn $40.25?

12. A merchant failed in business and could pay only $0.625 on each dollar he owed; how much did he owe a creditor to whom he paid $500?

13. A man bought .125 of a bushel of clover seed for $1; what was the price per bushel?

14. A cubic foot of water weighs 62.5 lb.; how many cubic feet are there in a ton of 2000 lb.?

REVIEW

Exercise 28

1. Each of two boys has $0.20; how much more must they together get to have $1?

2. If 3 lb. of coffee cost $0.90, what should $\frac{1}{2}$ lb. cost at the same rate?

3. A boy won 6 marbles, which was $\frac{3}{5}$ of what he already had; what was then his total number of marbles?

4. A contractor paid $30 to 3 men for 5 days' labor. To one he paid $9 and to another $12; how much did he pay the third?

5. A tank containing 60 gal. of water is emptied by a spigot in 20 min.; what quantity flows through the spigot in 10 min.?

6. A boy bought 4 lb. of sugar at $6\frac{1}{2}¢$ per pound and 1 lb. of coffee at $30¢$; how much change should he receive if he gave in payment $1?

7. A boy has 20 nickels, 5 dimes, and 6 quarter dollars; how much money has he?

8. A boy sells 60 lb. of scrap iron at the rate of 4 lb. for $1¢$; how much does he receive for it?

9. Two pairs of shoes cost $6; if 1 pair cost $3.75, what did the other pair cost?

10. Under ordinary conditions sweet corn will yield 2000 lb. to the acre; how many pounds should $\frac{3}{8}$ acre yield?

11. Under ordinary conditions tomatoes yield 300 lb. of seed to the acre; how many acres will yield 1350 lb.?

12. A dealer bought 3 lots for $1000. He sold one of them for $500, another for $250; what must he receive for the third so that he may have a profit of $200 on the 3 lots?

13. If a man earns $2 per day for 6 days of the week and saves $3 per week, how much does he spend per week?

14. How much must be added to the sum of $25 and $16.25 to make $100?

15. A fruit dealer bought $\frac{1}{3}$ as many oranges as he had on hand. He now has 16 doz.; how many dozen had he before the purchase?

16. In 1910 twice as many hogs were packed in Chicago as in Kansas City; 5,133,578 hogs were packed in Chicago that year. How many were packed in Kansas City?

17. In 1910 Portugal produced .253 as much wine as Spain, which produced 428,000,000 gal.; how much did Portugal produce?

18. A merchant failed in business and could pay only \$0.875 to the dollar; how much would a man lose to whom the merchant owed \$350?

19. Find the amount of the following sales of potatoes:

10 bu. @ \$1.30 per bushel,
12 bu. @ \$0.20 per peck,
8 bu. @ \$0.15 per half peck.

20. Fill in the missing amounts in the following:

One Man's Experience Both Ways

Here is the comparative cost of hauling whole milk, as against hauling cream alone, as figured by one dairyman from his actual experience with both methods:

Cost of Hauling Whole Milk		Cost of Hauling Cream Only	
20 weeks, 5 deliveries per week, 5 hours per day, with heavy wagon, time of man and team valued at 20 cents per hour	\$	20 weeks, 3 deliveries per week, 2½ hours per day, with light wagon, time of man and team valued at 20 cents per hour	\$
32 weeks, 3 deliveries per week, 5 hours per day, with heavy wagon, time of man and team valued at 20 cents per hour	\$	32 weeks, 2 deliveries per week, 2½ hours per day, with light wagon, time of man and team valued at 20 cents per hour	\$
Total cost per year of delivering whole milk	\$	Total cost per year of delivering cream only	\$

YEARLY SAVING THROUGH HAULING CREAM ONLY . . . \$

BUSINESS PROBLEMS

Domestic Postage

26. DOMESTIC POSTAGE RATES.

(Apply to Mail Matter for Canada, Canal Zone, Cuba, Guam, Hawaii, Mexico, Philippines, Porto Rico, Republic of Panama, Tutuila, and the U. S. Postal Agency at Shanghai. The Domestic Rate for Letters, but not for Other Articles, applies also to Germany, Great Britain and Ireland, and Newfoundland.)

First-class. Letters and sealed matter: 2 cts. for each ounce or fraction. Postal cards and Post cards: 1 ct. each.

Second-class. Newspapers and periodicals: 1 ct. for each four ounces or fraction.

Third-class. Miscellaneous printed matter, except books weighing over eight ounces; 1 ct. for each two ounces or fraction.

Fourth-class. All matter not included in first three classes and weighing four ounces or less: 1 ct. for each ounce or fraction.

Special-delivery. A special-delivery stamp (or 10 cts. in ordinary stamps when the letter or parcel is marked "Special Delivery") in addition to postage, secures immediate delivery within the carrier limits of city delivery offices between the hours of 7 A.M. and 11 P.M. and within one mile of all other United States post offices between the hours of 7 A.M. and 7 P.M.

Exercise 29

1. What is the postage on a letter weighing 2 ounces?
2. What is the postage on a letter weighing $1\frac{1}{2}$ ounces?
3. What is the postage on a letter weighing 5 ounces?
4. What is the postage on a letter weighing $4\frac{1}{2}$ ounces?
5. What is the postage on a package of newspapers weighing 8 ounces?
6. What is the postage on a package of newspapers weighing 7 ounces?
7. What is the postage on a magazine weighing 12 ounces?
8. What is the postage on a magazine weighing 10 ounces?

Books weighing eight ounces or less are mailed as third-class matter.

9. What is the postage on a book weighing 4 ounces?

10. What is the postage on a book weighing 8 ounces?

11. What is the postage on a book weighing 7 ounces?

12. What is the postage on a book weighing $5\frac{1}{2}$ ounces?

13. What is the postage on a package of merchandise weighing 4 ounces?

14. What is the postage on a $3\frac{1}{2}$-oz. box of merchandise?

15. What is the postage on a package of circulars weighing 9 ounces?

16. What is the postage on a box of medicine weighing $2\frac{1}{2}$ ounces?

17. What is the postage on a 3-ounce letter which also bears a special delivery stamp?

18. What is the postage on a 6-ounce book if the package has also a special delivery stamp upon it?

To insure a piece of mail against loss not exceeding \$50, it may be *registered*, the rate being 10¢ on each piece in addition to the regular postage. A piece of registered mail must bear the name and address of the sender.

19. Find the cost of sending a registered letter weighing $1\frac{1}{2}$ ounces.

20. Find the cost of sending a registered letter weighing 3 ounces.

21. Find the cost of sending a registered parcel containing merchandise weighing $2\frac{1}{2}$ ounces.

Money Orders

Money may be paid by means of postal money orders, which may be obtained at post offices; also by means of express money orders, which may be obtained at the offices of express companies.

United States Post-Office Money Orders

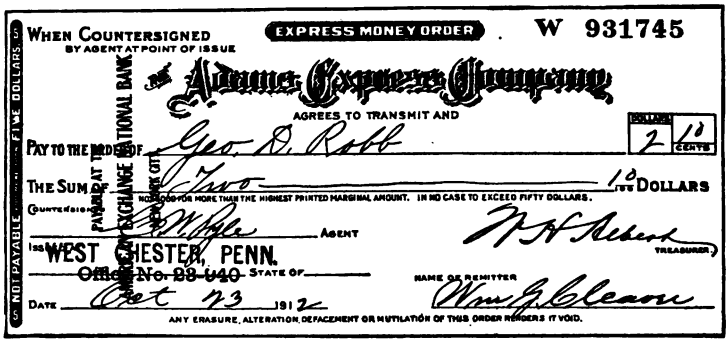
FEES FOR MONEY ORDERS DRAWN ON DOMESTIC FORM

27. Payable in the United States (which includes Hawaii and Porto Rico) and its possessions, comprising the Canal Zone (Isthmus of Panama), Guam, the Philippines and Tutuila, Samoa; also for Orders payable in Bermuda, British Guiana, British Honduras, Canada, Cuba, Mexico, Newfoundland, the United States Postal Agency at Shanghai (China), the Bahama Islands, and certain other Islands in the West Indies mentioned in Register of Money Order Post Offices.

For Orders	From $ 0.01	to $ 2.50	..... 3 cents.
	From $ 2.51	to $ 5.00	..... 5 cents.
	From $ 5.01	to $ 10.00	..... 8 cents.
	From $ 10.01	to $ 20.00	.....10 cents.
	From $ 20.01	to $ 30.00	.....12 cents.
	From $ 30.01	to $ 40.00	.....15 cents.
	From $ 40.01	to $ 50.00	.....18 cents.
	From $ 50.01	to $ 60.00	.....20 cents.
	From $ 60.01	to $ 75.00	.....25 cents.
	From $ 75.01	to $ 100.00	.....30 cents.

To THE TEACHER. — Pupils should be encouraged to secure and fill out properly the forms used in making application for postal money orders.

Express Money Orders


WHEN COUNTERSIGNED
BY AGENT AT POINT OF ISSUE
EXPRESS MONEY ORDER
W 931745
Adams Express Company
AGREES TO TRANSMIT AND
PAY TO THE ORDER OF
Geo. D. Robb
DOLLARS 2 CENTS 10
THE SUM OF
Two
10/100 DOLLARS
NOT GOOD FOR MORE THAN THE HIGHEST PRINTED MARGINAL AMOUNT. IN NO CASE TO EXCEED FIFTY DOLLARS.
COUNTERSIGNED
AGENT
TREASURER
WEST CHESTER, PENN.
Office No. 23-040 STATE OF
NAME OF REMITTER
Wm G Cleaver
DATE Oct 23 1912
ANY ERASURE, ALTERATION, DEFACEMENT OR MUTILATION OF THIS ORDER RENDERS IT VOID.
PAYABLE AT THE EXCHANGE NATIONAL BANK
NOT PAYABLE OVER FIVE DOLLARS

RATES FOR EXPRESS MONEY ORDERS

28.

Not over	$2.50	3c.
"	5.00	5c.
"	10.00	8c.
"	20.00	10c.
"	30.00	12c.
"	40.00	15c.
"	50.00	18c.
"	60.00	20c.
"	75.00	25c.
"	100.00	30c.

Over $100.00 at above rates.

1. I bought a pair of skates for $3 and a sled for $2.50. What was the fee for the post-office money order sent in payment? What was the total cost?

2. What is the fee for a post-office money order for $1.85? for $2.40? for $2.60? for $5.70?

3. What is the total cost of the post-office money order made in payment of 20 yd. of carpet bought at $1.45 a yard?

4. A man living in Philadelphia ordered the following bill of goods from a New York store: 2 saws each costing $2, a hammer costing $.75, and a hatchet costing $1.00. What fee did he pay for the express money order sent in payment of the goods? What was the total cost?

5. I bought the following bill of goods from Sears, Roebuck, and Co.: one refrigerator costing $23.85, one couch costing $10.35, a chair for $2.75, and a pair of shoes for $3. Find what fee I paid for the express money order sent in payment of the bill and the total cost.

Shipping Problems

Exercise 30

1. Find the cost of shipping by freight (1st class) 250 lb. of carpet, from Chicago to Boston, the rate being $0.82 per 100 lb. What would it cost to ship the carpet by express, the rate being $2.50 per 100 lb.?

2. Find the cost of shipping by freight (1st class) 675 lb. of furniture from Chicago to Cincinnati, the rate being $0.40 per 100 lb. What would it cost to ship this furniture by express, the rate being $1.50 per 100 lb.?

3. Find the cost of shipping by freight (2d class) 350 lb. of hardware, from Chicago to Savannah, the rate being $1.10 per 100 lb.

4. Find the cost of shipping by freight (3d class) 560 lb. of farm implements from Chicago to Baltimore, the rate being $0.47 per 100 lb.

5. Find the cost of shipping by freight (4th class) 1260 lb. steel roofing from Chicago to Wheeling at $0.30 per 100 lb.

Farm Problems

29. Account of the expenditures and receipts of a ten-acre field of wheat; copy, and supply the missing amounts:

	Expenditures			
	Interest on capital	per acre	$2.00	
Sept. 5	Plowing, man and team,	6½ da. @	3.00	
" 12	Harrowing, man and team,	7 hr. @	.30	
" 25	Harrowing, man and team,	7 hr. @	.30	
Oct. 12	Harrowing, man and team,	7 hr. @	.30	
" 15	Drilling, man and team,	1 da. @	3.00	
" 15	Seed	1½ bu. per acre @	1.15	
July 5	Harvesting	per acre	.60	
" 5	Twine	per acre	.25	
" 10	Stacking	per acre	.50	
" 30	Thrashing	250 bu. @	.04	
" 30	Labor	1 da. 4 men @	1.50	
	Total			
	Receipts			
Aug. 1	250 bu. wheat	@	$ .90	
" 1	20 T. straw	@	2.00	
	Total			
	Expenditures to be deducted			
	Net profit from 10 acres			
	" " per acre			

30. Account of the expenditures and receipts of a ten-acre field of corn; copy, and supply the missing amounts:

		Expenditures			
		Interest on capital	per acre $2.00		
Apr.	1–9	Plowing, man and team,	$6\frac{1}{2}$ da. @ 3.00		
"	10	Harrowing, man and team,	7 hr. @ .30		
"	25	Harrowing, man and team,	7 hr. @ .30		
May	10	Harrowing, man and team,	7 hr. @ .30		
"	10	Planting, man and team,	14 hr. @ .30		
"	10	Seed	5 pecks @ .30		
"	25	Cultivating, man and team,	$1\frac{2}{3}$ da. @ 3.00		
June	5	Cultivating, man and team,	$1\frac{2}{3}$ da. @ 3.00		
"	16	Cultivating, man and team,	$1\frac{2}{3}$ da. @ 3.00		
"	20	Cultivating, man and team,	$1\frac{2}{3}$ da. @ 3.00		
Sept.	20	Cutting and shocking, 4 men,	$2\frac{1}{2}$ da., per day 1.50		
Oct.	25	Husking, 4 men 4 da.,	per day 1.50		
"	25	Cribbing, man and team,	$1\frac{2}{3}$ da. @ 3.00		
		Total			
		Receipts			
Feb.	25	500 bu. corn	@ .58		
"	25	25 T. stover	@ 2.50		
		Total			
		Expenditures to be deducted			
		Net profit from 10 A.			
		" " per acre			

Note.—Pupils should be encouraged to learn whether or not the prices and facts stated in problems relating to industries are in accord with those in their community, and to make problems corresponding to those given, using such prices and facts.

RATIO

DEFINITIONS AND EXERCISES

31. The **ratio** of one number to another is the quotient obtained by dividing the first by the second.

Thus, the ratio of 12 to 4 is $12 \div 4$, or 3.

32. The ratio of one amount to a similar amount is the number of units in the first divided by the number of units in the second.

Thus, the ratio of \$12 to \$3 is $12 \div 3$, or 4.

Exercise 31

1. What is the ratio of 18 to 12?

Answer thus: the ratio of 18 to 12 is $18 \div 12$, or $\frac{18}{12}$, or $1\frac{1}{2}$.

2. What is the ratio of 12 to 6?
3. What is the ratio of 15 to 5?
4. What is the ratio of 20 to 8?
5. What is the ratio of 4 to 5?
6. What is the ratio of 8 to 10?
7. What is the ratio of 36 to 24?
8. What is the ratio of 20 to 30?
9. What is the ratio of 100 to 200?
10. What is the ratio of 500 to 200?
11. What is the ratio of 5 to $2\frac{1}{2}$?
12. What is the ratio of 15 to $7\frac{1}{2}$?

13. What is the ratio of \$10 to \$$2\frac{1}{2}$?

Answer thus: the ratio of \$10 to \$$2\frac{1}{2}$ is $10 \div 2\frac{1}{2}$, or 4.

14. What is the ratio of \$5 to \$15?

15. What is the ratio of \$25 to \$$12\frac{1}{2}$?

16. What is the ratio of $37\frac{1}{2}$ yd. to $12\frac{1}{2}$ yd.?

17. What is the ratio of $87\frac{1}{2}$ bu. to $12\frac{1}{2}$ bu.?

18. What is the ratio of 20 to $30 + 50$?

19. What is the ratio of 3 to $2 + 3 + 5$?

Notice that the ratio of 15 to 3 expresses the number of 3's in 15; also the ratio of 6 to 12 expresses the part 6 is of 12.

20. If 6 lb. of sugar cost 36¢, what should 9 lb. cost at the same rate?

SUGGESTION. — 9 lb. = $\frac{3}{2}$ of 6 lb.
Therefore, $\frac{3}{2}$ of 36¢, or ——, = the required cost.

21. If 8 yd. of cloth cost 56¢, what should 4 yd. cost at the same price per yard?

22. If \$2 was paid to a laborer for 10 hr. of work, what should he be paid for 8 hr. of work?

23. What should be paid for 2 qt. of vinegar at the rate of 30¢ a gallon?

24. What should 500 lath cost if 1000 lath cost \$3?

ANIMAL FOODS

Exercise 32

A good mixed dry feed for poultry can be made in any desired quantity from Formula A.

Formula A

200 lb. wheat bran
100 lb. middlings
100 lb. corn meal

Refer to Formula A in answering questions 1–5.

1. What part of the mixture is corn meal?

2. What part of the mixture is wheat bran?

3. How many pounds of each ingredient are there in a ton of the mixture?

4. How many pounds of each ingredient are found in 100 lb. of the mixture?

5. How many pounds of each ingredient are there in 50 lb. of the mixture?

A good mixed feed for chickens from 3 days to 3 weeks old can be made in any desired quantity from Formula B.

Formula B

28 lb. cracked wheat
20 lb. granulated oatmeal
30 lb. fine screened cracked corn
4 lb. fine cracked peas
4 lb. broken rice
10 lb. chick grit
4 lb. fine charcoal (chick size)

Refer to Formula B in answering questions 6–12.

6. What part of the mixture is cracked wheat?

7. What part of the mixture is chick grit?

8. What part of the mixture is cracked corn?

9. What part of the mixture is granulated oatmeal?

10. How many pounds of each ingredient are found in 500 lb. of the mixture?

11. How many pounds of each ingredient are there in a ton of the mixture?

12. How many pounds of each ingredient are there in 50 lb. of the mixture?

Standard Daily Ration for a 1000-pound Horse

10 lb. hay (timothy)
12 lb. oats

Refer to Ration given above in answering questions 13–16.

13. How much hay and how much oats will the horse be given in a week?

14. How much hay and how much oats will the horse consume during the month of October?

15. How many bushels of oats would be required to keep this horse a year provided he was fed no other grain than oats? (Count 32 lb. to the bushel.)

16. Find the cost of the hay this horse would consume in one year, the hay costing $25 a ton.

Value of Other Foods compared with Hay

It is estimated that 100 lb. of good hay will possess the same feeding value as:

44½ lb. of wheat	59 lb. of oats
62½ lb. of corn	53½ lb. of rye
669 lb. of beets	360 lb. of potatoes
28 lb. of beans	347 lb. of oat straw
58 lb. of barley	429 lb. of rye straw

17. One ton of hay has the same feeding value as how many pounds of wheat?

18. One ton of hay has the same feeding value as how many pounds of oat straw?

19. How much rye straw has the same feeding value as 500 lb. of hay?

20. How much corn has the same feeding value as one ton of hay?

21. How much barley has the same feeding value as one ton of hay?

22. Fifty pounds of hay have the same feeding value as how many pounds of beans?

23. Thirty-six pounds of potatoes have as much feeding value as how many pounds of hay?

24. Ten pounds of hay have as much feeding value as how many pounds of beets? how many pounds of oats? how many pounds of rye?

REVIEW

Exercise 33

1. Good wheat will produce about .42 of its weight of finest flour, and in addition .18 of its weight of seconds and .09 of its weight of biscuit flour; how many pounds of each of these grades of flour are produced from a bushel of wheat weighing 60 pounds?

2. What is the value of 4 loads of hay weighing respectively: 1800 lb., 1650 lb., 1760 lb., and 1850 lb., at $18 per ton?

3. I owed a bill amounting to $28, and paid $21 on it; what part of the bill do I still owe?

4. The weight of dressed hogs is about 80 lb. to each 100 lb. of their live weight; how much should a hog whose live weight is 350 lb. weigh, when dressed?

5. A ten-acre field of wheat yielded 12,000 lb. of wheat and 20,000 lb. of straw; how many bushels (60 lb.) of wheat did it yield, and how many tons (2000 lb.) of straw? How many bushels of wheat did this field yield per acre, and how many tons of straw?

6. Dried apples weigh about 26 lb. per bushel; how many bushels are there in 273 lb.?

7. A gallon of water weighs 8.36 lb.; what does a quart of water weigh?

8. Steers should be fed each day hay or its equivalent to the amount of 2.84 lb. for each 100 lb. of their live weight. How much hay or its equivalent should be fed per day to a 760-lb. steer?

9. How many cakes can be bought for 25 ¢ at the rate of 10 ¢ per dozen?

10. A family that uses 16 eggs per day uses how many dozen in 9 days?

11. A produce dealer bought 50 baskets of peaches for $ 25 and retailed them at 75 ¢ per basket; what was his profit?

12. Hay well dried in the field loses about $\frac{1}{3}$ of its weight if allowed to dry out and pack in the mow; what weight of dry hay from the field will weigh 10 tons (2000 lb.) when settled in the mow?

13. A drover sold a steer for $ 63. If it weighed 1050 lb., what did the drover receive per pound for it?

14. A huckster had 20 doz. eggs. If he sold $2\frac{1}{2}$ doz. to one woman, 6 eggs to another, $1\frac{1}{2}$ doz. to another, what did he receive for the remainder of them if he sold them at 30 ¢ per dozen?

15. A barrel of good lime is used in laying 1000 bricks; how many barrels of lime are needed to lay 8750 bricks?

16. Find the cost of shipping 3650 lb. of potatoes at 6 ¢ per 100 lb.

17. First-class fitters and cutters in factories of large cities receive \$25 per week, while plain sewers receive but \$5 per week. What wages do 10 fitters and cutters and 6 plain sewers earn in one week?

18. How much more is paid per year for *The Saturday Evening Post* bought at 5¢ per copy, 52 numbers per year, than if it were subscribed for at \$1.50 per year?

19. Simplify:

$$\frac{.02 \div .002}{.002 \div .02}$$

20. Find the cost of shipping by freight (1st class) 125 lb. of electrical goods from Chicago to Seattle, the rate being \$3.00 per 100 lb. What would it cost to ship these goods by express, the rate being \$11.50 per 100 lb.?

21. Find the total cost of a post-office money order for \$25.

22. For a spray to kill chewing insects 5 oz. of Paris green may be mixed with 50 gal. of water and 1 lb. of fresh burned lime. How much water should be used with $\frac{1}{2}$ lb. of Paris green?

23. In a recent year the corn crop of the United States was estimated at 3,125,713,000 bu., valued at \$0.40 per bushel; what was the total value of the crop?

24. Oats is estimated to yield 1600 lb. of grain and 3000 lb. of straw to the acre. At this estimate how many bushels of oats (32 lb.) and how many tons (2000 lb.) of straw should a 12-acre field produce?

DENOMINATE AMOUNTS

REVIEW AND EXTENSION

Exercise 34

1. Write the table of Liquid Measure.

2. Write the table of Dry Measure.

3. What use is made of the hundredweight?

4. How many pounds are there in a long ton?

5. Name four articles that are bought by the short ton.

6. What is the weight of a barrel of flour?

7. Write the table of Time.

8. Name the centennial years, beginning with 1500 and ending with 1900.

9. Is the present year a leap year?

10. When was the last leap year?

11. When will the next leap year be?

12. How many hours are there from midnight to noon?

13. How is the third hour of the day written?

14. What is the thirteenth hour of the day called?

15. How many hours are there from 9 P.M. to 3 A.M. of the next day?

16. How is the sixth hour after noon written?

17. How is seven hours and fifteen minutes after midnight written?

18. What does 12.01 P.M. mean?

19. How many hours elapse from 8.30 A.M. to 12.30 P.M.?

20. Was the year 1800 a leap year?

21. A man's journey began at 10 P.M. and lasted 8 hours; when did it end?

22. Name the months that have 31 days.

23. Write the table of Length.

24. What is the fathom used to measure?

25. How deep is the sea at a certain point if it is 100 fathoms deep?

26. What is the hand used to measure?

27. Find out how the height of a horse is measured.

28. Find how many feet there are in a statute mile.

29. Which is the longer, and by how many feet, a knot or a statute mile?

30. Find how many feet long a chain is.

31. Write the table of Angular Measure.

32. Write the table of Square Measure.

33. Write the table of Cubic Measure.

34. What is a plane surface?

35. What is a square?

36. How is the area of a square found?

37. What is another name for a square rod?

38. What is meant by the perimeter of a square?

39. What is a rectangle?

40. How is the area of a rectangle found?

41. What is a cube?

42. How many faces has a cube? how many corners? how many edges?

43. How is the number of cubic units in a cube found?

44. Write the table of Cubic Measure.

45. What is the weight of two cubic feet of water?

46. How many cubic feet are there in four stricken bushels?

47. How many cubic inches are there in a wine gallon?

48. What is a rectangular solid?

49. How is the number of cubic units in a rectangular solid found?

50. Tell how long, how wide, and how high a cord of wood is.

Exercise 35

Read the following, supplying the missing number at sight:

1. 1 pint = —— gills.
2. 1 minute = —— seconds.
3. 1 quart = —— pints.
4. 1 foot = —— inches.
5. 1 hogshead = —— gallons.

6. 1 cubic foot = —— cubic inches.
7. 1 leap year = —— days.
8. 1 short ton = —— pounds.
9. 1 hand = —— inches.
10. 1 square yard = —— square feet.
11. 1 gallon = —— quarts.
12. 1 day = —— hours.
13. 1 barrel = —— gallons.
14. 1 pound = —— ounces.
15. 1 century = —— years.
16. 1 fathom = —— feet.
17. 1 square foot = —— square inches.
18. 1 cord = —— cubic feet.
19. 1 peck = —— quarts.
20. 1 hour = —— minutes.
21. 1 yard = —— feet.
22. 1 cubic yard = —— cubic feet.
23. 1 bushel = —— pecks.
24. 1 common year = —— days.
25. 1 rod = —— yards.
26. 1 week = —— days.
27. 1 acre = —— square rods.
28. 1 chain = —— rods.

29. 1 year = —— months.
30. 1 right angle = —— degrees.
31. October has —— days.
32. 1 gallon = —— cubic inches.
33. August has —— days.
34. 1 hogshead = —— barrels.
35. 1 square rod = —— square yards.
36. 1 year = —— weeks (nearly).

LINES AND SURFACES

Measuring to a Scale

Exercise 36

1. Measure the parts of AE and tell how long each is.

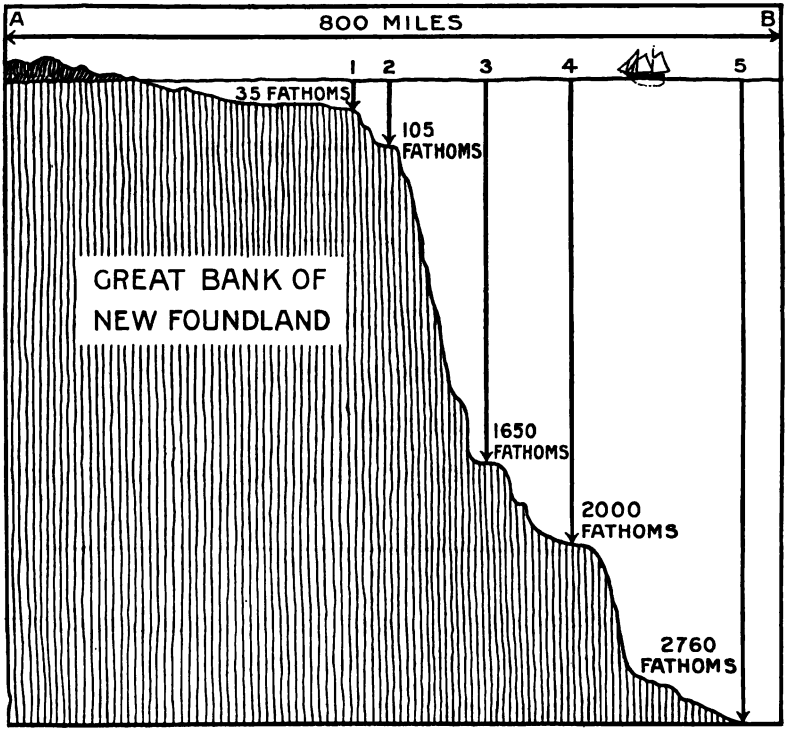
If AB represents 1 mi., we say that line AE is drawn to a scale of 1 in. to 1 mi. and we write:

Scale: 1 in. = 1 mi.; *or in practice:* 1″ = 1 mi.

2. When the scale is 1″ = 1 mi., what is the distance from A to C? from B to D? from A to E? from B to E? from C to E?

3. When the scale is 1″ = 100 ft. (′), what is the distance from A to B? from A to C? from B to C? from C to D? from B to D? from D to E?

4. Measure the distance from A to B on the following diagram and tell how many miles each inch represents.

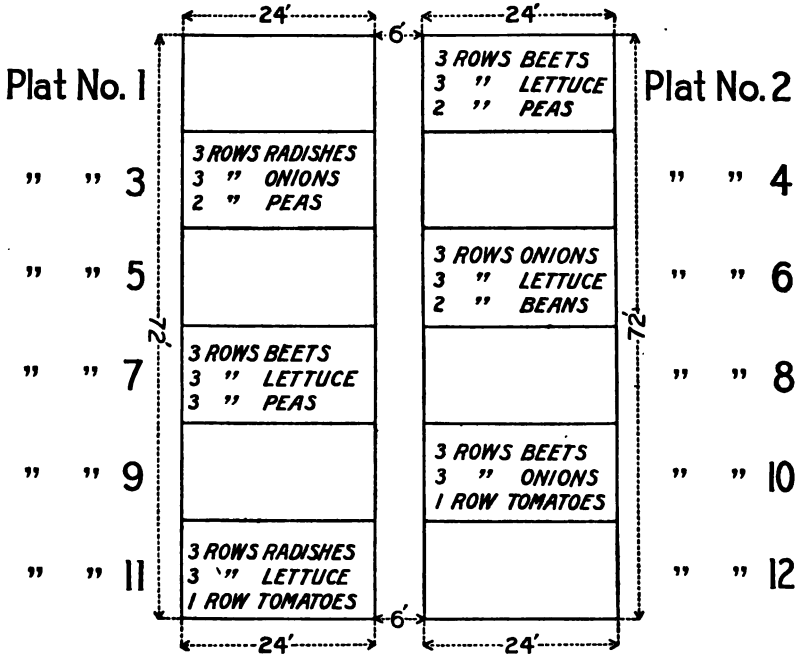


5. How many miles are represented on this map from arrow 1 to arrow 2? from arrow 2 to arrow 3?

6. How many miles are represented on this map from arrow 3 to arrow 4? from arrow 4 to arrow 5?

7. How many feet deep is the ocean at arrow 1? at arrow 2? at arrow 3? at arrow 4? at arrow 5?

Exercise 37. School Garden



Scale: 1" = 24'.

1. How many square feet are there in each plat?

From 6 to 10 rows, running lengthwise, of vegetables may be planted in each plat, as here shown.

2. Tomatoes are set out 4 ft. apart in a row. The first plant at each end of a row being 2 ft. from the end, how many tomato plants are required to plant the row shown in plat 11?

3. Cabbage plants are set out in rows 3 ft. apart. How many rows running lengthwise can be planted in plat 12, when each outside row is $1\frac{1}{2}$ ft. from the edge?

4. Lettuce plants are set out 1 ft. apart in the row. The plant at each end of a row being 6 in. from the end, how many lettuce plants were required to plant the 3 rows in plat 2?

5. Sweet corn is planted in rows 3 ft. apart, the hills being 2 ft. apart in a row. If the row at each edge is $1\frac{1}{2}$ ft. from the edge and the hill at each end of a row is 1 ft. from the end, how many hills of sweet corn can be planted in plat 5?

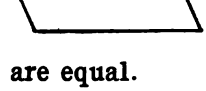
6. What is the area of the walk shown between the plats?

7. How many feet of fence would inclose plat 1?

8. What is the distance around the school garden?

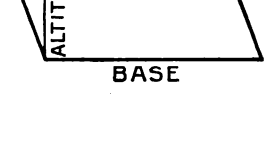
Parallelograms and Triangles

33. A **parallelogram** is a four-sided plane figure whose opposite sides are parallel.



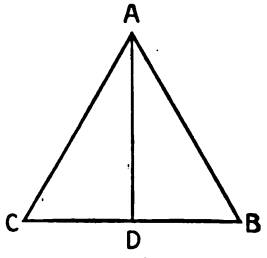
34. The opposite sides of a parallelogram are equal.

35. The side of a parallelogram on which it is supposed to stand is called the **base**, and the perpendicular drawn from the side opposite the base to the base is called the **altitude**.

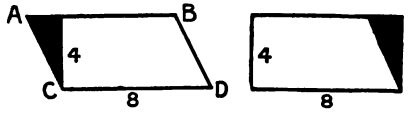


36. A **triangle** is a plane figure bounded by three straight lines.

37. The side of a triangle on which it is supposed to stand is called the **base,** and the perpendicular drawn from the vertex of the angle opposite the base to the base or the base extended is called the **altitude.**

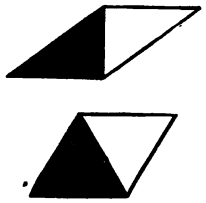


38. *ABCD* is a parallelogram whose base is 8 units and altitude 4 units. *ABCD* may be changed, as shown in the figure to the right of it, into a rectangle 8 units long and 4 units wide. The area of the rectangle is 4×8. Therefore the area of *ABCD* is 4×8.



39. The area of a parallelogram equals the number of units in its base multiplied by the number of units in its altitude.

40. Each triangle in black is one half of a parallelogram with the same base and altitude as the triangle. The area of a parallelogram is the number of units in its base multiplied by the number of units in its altitude.



41. The area of a triangle equals the number of units in its base multiplied by one half the number of units in its altitude.

Exercise 38

1. One side of a parallelogram is 6 ft.; how long is the opposite side?

2. One side of a parallelogram is 8 ft., and another side is 5 ft. What is the distance around (the perimeter of) the parallelogram?

3. The perimeter of a parallelogram is 20 ft. If one side of it is 6 ft., what is the length of each of the other sides?

Find the areas of parallelograms having bases and altitudes as follows:

	4.	5.	6.	7.	8.	9.
Base	6 ft.	12 ft.	8 ft.	16 in.	4 in.	5.5 ft.
Altitude	4 ft.	6 ft.	4.5 ft.	14 in.	2.5 in.	3.5 ft.

10. If the sides of a triangle are 2 ft., 3 ft., and 4 ft., what is the distance around (the perimeter of) the triangle?

11. The perimeter of a triangle is 15 ft. If one side of it is 6 ft., and another side is 4 ft., what is the third side?

Find the areas of triangles having bases and altitudes as follows:

	12.	13.	14.	15.	16.	17.
Base	8 ft.	3 ft.	10 ft.	8 in.	12 in.	4.5 ft.
Altitude	12 ft.	4 ft.	9 ft.	6 in.	7 in.	5 ft.

18. One side of a parallelogram is 8 ft., the distance around it is 50 ft.; how long is each of its sides?

Practical Measurements

Carpeting

42. Carpets are either 1 yd. or $\frac{3}{4}$ of a yard wide. The cheaper carpets are 1 yd. wide and the higher grades, such as velvet, Wilton, and Axminster, $\frac{3}{4}$ of a yard wide. Linoleum and oilcloth are usually sold by the square yard.

43. In determining the number of yards of carpet required for a floor, the number of strips needed should be found; a fractional part of a strip should be regarded as a full strip.

Thus, if a floor is 10 ft. 6 in. wide and carpet is $\frac{3}{4}$ of a yard, or $2\frac{1}{4}$ ft. wide, then, $10\frac{1}{2} \div 2\frac{1}{4}$, or $4\frac{2}{3}$ = the number of strips that will cover the floor, and since a part of a strip cannot be bought, 5 strips must be bought.

REMARK. — In practice it is seldom possible, because of the great variety of patterns with which carpets are woven, to estimate the exact amount necessary for a room.

44. The number of yards of carpet $\frac{3}{4}$ yd. wide that must be bought to carpet a room 24 ft. long and 15 ft. wide with the strips laid lengthwise may be found as follows:

15 ft., or 180 in. = the width of the floor.
$\frac{3}{4}$ yd., or 27 in. = the width of a strip of carpet.
$180 \div 27$, or $6\frac{2}{3}$ = the number of strips needed.
Then, 7 strips must be bought.
24 ft., or 8 yd. = the length of a strip.
Then, 7×8, or 56 = the number of yards required.

Exercise 39

1. How many strips of carpet, 1 yd. wide, must be bought to carpet a room 12 ft. wide, the strips to be laid lengthwise?

2. How many strips of carpet, $\frac{3}{4}$ yd. wide, must be bought to carpet a room 18 ft. wide, the strips to be laid lengthwise?

3. How many strips of carpet, $\frac{3}{4}$ yd. wide, must be bought to carpet a room 14 ft. wide, the strips to be laid lengthwise?

4. How many strips of carpet, $\frac{3}{4}$ yd. wide, must be bought to carpet a room 27 ft. long, the strips to be laid crosswise?

5. How many strips of carpet, $\frac{3}{4}$ yd. wide, must be bought to carpet a room 20 ft. long and 18 ft. wide:

1st, if the strips are to be laid lengthwise?
2d, if the strips are to be laid crosswise?

6. How many yards of carpet, 1 yd. wide, must be bought to carpet a floor 15 ft. long and 12 ft. wide?

7. How many yards of carpet, $\frac{3}{4}$ yd. wide, must be bought to carpet a floor 18 ft. long and $13\frac{1}{2}$ ft. wide?

8. Find the cost of carpeting a floor 24 ft. long and 18 ft. wide with carpet $\frac{3}{4}$ yd. wide, costing \$0.90 per yard, strips to be laid lengthwise.

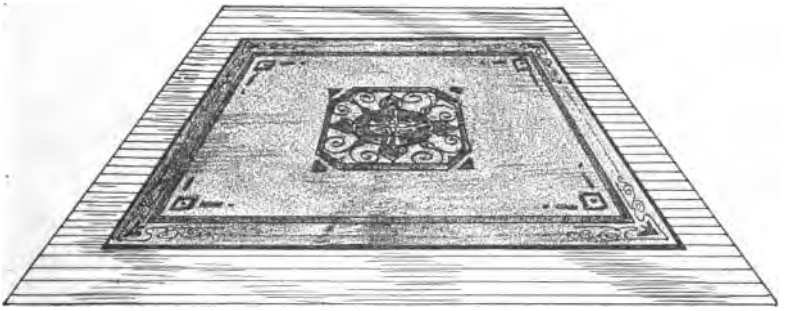
9. Make a drawing of a floor 18 ft. long and 16 ft. wide; scale: $2'' = 1'$; showing strips of carpet $\frac{3}{4}$ yd. wide running lengthwise on the floor. Find the cost of the carpet required, at \$1.20 per yard.

10. Make a drawing of a room 16 ft. long, 14 ft. wide; scale: $2'' = 1'$; showing strips of carpet $\frac{3}{4}$ yd. wide, running lengthwise on the floor. Find the cost of carpeting this room with carpet costing \$1.50 per yard, allowing $\frac{1}{2}$ yd. on each strip for waste in matching the pattern.

11. Find the cost of the linoleum required to cover the floor of a kitchen 18 ft. long and 12 ft. wide, the linoleum to cost 54¢ a square yard.

12. At 40¢ a square yard find the cost of the oilcloth required for a kitchen 12 ft. square.

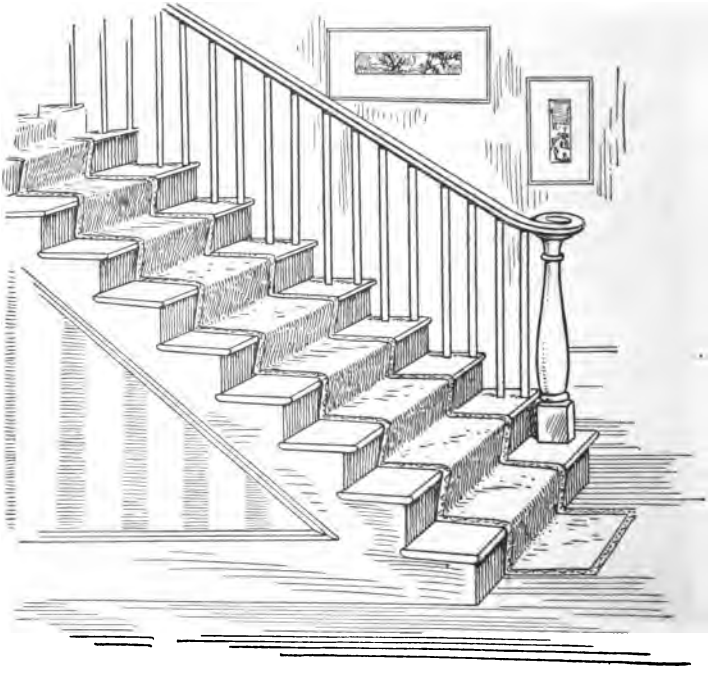
13. Here is a rug 9 ft. square placed in the center of a room 12 ft. square. The portion of the floor surrounding the rug is stained; how many square feet are stained?



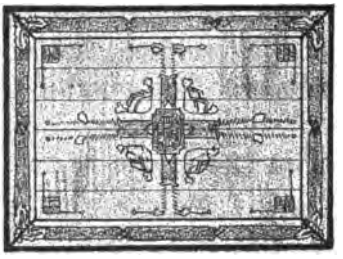
14. If a rug 8 ft. square is placed in the center of a room 12 ft. square, and the part of the floor remaining uncovered is finished at 8¢ per square foot, find the cost of finishing the part uncovered.

15. If a rug 12 ft. long and 10 ft. wide is placed in the center of a room 16 ft. long and 12 ft. wide, how many square feet of the floor remain uncovered?

16. The risers in these steps are 8 in. and the tread 10 in.; how many yards of stair carpet are required for the flight of stairs of 15 steps, the carpet to be carried over 1 ft. on the upper floor and to extend 1 ft. on the lower floor?



Sometimes the carpet of a room is surrounded by a border, which should be cut at each corner as in the diagram; the length of the border required is then the entire distance around the room.



NOTE. — Standard widths of borders are $\frac{1}{3}$ yd., $\frac{1}{2}$ yd., and $\frac{2}{3}$ yd.

17. Make a drawing of a floor 18 ft. long, 16 ft. wide; scale: $1'' = 1'$; showing strips of carpet $\frac{3}{4}$ yd. wide running lengthwise on this floor, and surrounded by a border $\frac{3}{4}$ yd. wide. How many yards of carpet and of border are required, no allowance being made for waste?

Lumber Measure

45. Lumber is usually bought and sold by **board measure.** The unit of board measure is the **board foot,** which is equivalent to the contents of a board a foot square and an inch thick.

46. The number of board feet in a board 16 ft. long and 8 in. wide ($16' \times 8''$) may be found thus:

16 = the number of feet in the length.

$\frac{8}{12}$ = the number of feet in the width.

$\frac{8}{12} \times 16$, or $\frac{8 \times 16}{12}$ = the number of board feet in the board.

47. The number of board feet in a board one inch thick equals the number of inches in the width times the number of feet in the length, divided by 12.

48. All boards less than one inch thick are bought and sold by surface measure, the thickness not being considered. The number of board feet in a board one inch, or less, in thickness is therefore the number of square feet of surface in one side of the board.

49. The number of board feet in a plank 16 ft. long, 6 in. wide, and 2 in. thick ($2'' \times 6'' \times 16'$) may be found thus:

$\frac{6 \times 16}{12}$ = the number of board feet in the plank if it were 1 in. thick.

$\frac{2 \times 6 \times 16}{12}$ = the number of board feet in the plank 2 in. thick.

50. The number of board feet in a piece of lumber more than an inch thick equals the number of inches in the thickness, times the number of inches in the width, times the number of feet in the length, divided by 12.

51. Instead of saying that a board contains 12 board feet we usually say that it contains 12 feet. Instead of quoting lumber at \$ 25 per 1000 board feet a lumberman quotes it at \$ 25 per M.

Exercise 40

Find the number of feet (board feet) of inch boards in each of the following:

	Number of Boards	Size	Number of Feet
1.	6	$16' \times 12''$	
2.	12	$12' \times 8''$	
3.	36	$10' \times 6''$	
4.	48	$14' \times 6''$	

Find the number of feet (board feet) in each of the following:

	Number of Pieces	Size	Number of Feet
5.	18	$2'' \times 6'' \times 14'$	
6.	12	$2'' \times 4'' \times 16'$	
7.	10	$2'' \times 4'' \times 14'$	
8.	6	$5'' \times 5'' \times 18'$	
9.	17	$3'' \times 6'' \times 18'$	
10.	18	$2'' \times 8'' \times 12'$	
11.	20	$3'' \times 4'' \times 9'$	
12.	25	$3'' \times 9'' \times 8'$	
13.	10	$4'' \times 4'' \times 12'$	
14.	8	$5'' \times 6'' \times 12'$	
15.	75	$2'' \times 5'' \times 18'$	
16.	24	$2'' \times 8'' \times 12\frac{1}{2}'$	

17. Find the cost of 10 boards $16' \times 9''$ at \$30 per M.

18. Find the cost of 40 boards $12' \times 6''$ at \$32 per M.

19. Find the cost of 60 pieces of scantling $3'' \times 4'' \times 12'$ at \$28 per M.

20. Find the cost of a load of lumber consisting of:

20 planks $2'' \times 6'' \times 12'$ at \$24 per M,

42 boards $16'' \times 12'$ at \$36 per M.

21. At \$24 per thousand feet find the cost of 80 fence boards $16' \times 6''$.

22. Find the cost of 12 posts $6'' \times 6'' \times 8'$ at \$40 per M.

23. Find the cost of 60 flooring boards $16' \times 3\frac{1}{2}''$ at \$32 per M square feet.

24. Find the cost of 12 planks $1\frac{1}{2}'' \times 6'' \times 14'$ at \$35 per M.

25. Find the cost of a stick of timber 50 ft. long, 18 in. wide, and 10 in. thick at \$40 per M.

26. At \$24 per M., what is the value of a pile of lumber 16 ft. long, 8 ft. wide, and 6 ft. high?

Papering

52. Wall paper is generally 18 in. wide and is sold by the roll. A single roll is 8 yd. long, and a double roll 16 yd. long. Border paper is sold by the yard and is of various widths; molding is sold by the foot.

Exercise 41

1. How many square yards are there in a single roll of paper?

2. How many square yards are there in a double roll of paper?

3. How many strips of paper are necessary to cover a wall 18 ft. long?

4. How many strips of paper are necessary to cover a ceiling 24 ft. long? (Strips running crosswise.)

5. How many strips 9 ft. long can be cut from a single roll of paper, and how much waste will there be?

6. How many yards of border are required for a room 24 ft. long and 18 ft. wide?

7. At 6¢ per foot, find the cost of the molding for a room 24 ft. long and $22\frac{1}{2}$ ft. wide.

8. How many strips of paper are required to paper the walls of a room 24 ft. long and 18 ft. wide, making no allowance for door or windows?

Plastering and Painting

53. In estimating labor, the square yard is taken as the unit in plastering and painting.

54. In making estimates, half the area of the doors, windows, and other openings is deducted from the total area and the result expressed to the nearest square yard.

Exercise 42

1. How many square yards of plastering are there in a wall 18 ft. long and 9 ft. high?

2. How many square yards of plastering are there in the ceiling of a room 24 ft. long and 18 ft. wide?

3. Find the cost, at 25¢ per square yard, of plastering a wall 24 ft. long and 12 ft. high, making the proper allowance for an opening $7\frac{1}{2}$ ft. by 6 ft.

4. Find the cost, at 25¢ per square yard, of plastering a wall 30 ft. long and 12 ft. high, making the proper allowance for one opening $7\frac{1}{2}$ ft. by 6 ft., and two openings each 6 ft. by 3 ft.

5. How many square yards of plastering are there in the walls of a room 21 ft. long, 18 ft. wide, and 9 ft. high, making no allowance for openings?

6. How many square yards of plastering are there in the walls and ceiling of a room 18 ft. long, 14 ft. wide, and 8 ft. high, making no allowance for openings?

7. At 20¢ per square yard, find the cost of plastering the walls and ceiling of a room 20 ft. by 18 ft. and 10 ft. high, making allowance for 3 windows, each 6 ft. by 4 ft.

8. Estimating that one gallon of paint is required to give 450 sq. ft. of surface one coat, how many gallons of paint are required to give one coat of paint to both sides of a tight board fence 150 ft. long and 6 ft. high?

COMPOUND AMOUNTS

55. A compound amount is a combination of two or more simple denominate amounts of the same kind of quantity, but of different denominations.

Thus, 3 yd. 2 ft. 4 in. is a compound amount.

REMARK. — Compound amounts are rapidly going out of use, except in the measurement of *time, angles,* and *arcs.*

Reduction

56. 1. Reduce 5 rd. 2 yd. 2 ft. to feet.

Explanation

1 rd. = $5\frac{1}{2}$ yd.

5 rd. = $5 \times 5\frac{1}{2}$ yd., or $27\frac{1}{2}$ yd.

5 rd. 2 yd. = $27\frac{1}{2}$ yd. + 2 yd., or $29\frac{1}{2}$ yd.

1 yd. = 3 ft.

$29\frac{1}{2}$ yd. = $29\frac{1}{2} \times 3$ ft., or $88\frac{1}{2}$ ft.

5 rd. 2 yd. 2 ft. = $88\frac{1}{2}$ ft. + 2 ft., or $90\frac{1}{2}$ ft.

The answer may be found thus:

5 − 2 − 2

$5\frac{1}{2}$

$27\frac{1}{2}$

2

$29\frac{1}{2}$

3

$88\frac{1}{2}$

2

$90\frac{1}{2}$

2. Reduce 149 pt. to gallons.

Explanation

The number of pints ÷ 2 = the number of quarts.

∴ 149 pt. = 74 qt. 1 pt.

The number of quarts ÷ 4 = the number of gallons.

∴ 74 qt. = 18 gal. 2 qt.

∴ 149 pt. = 18 gal. 2 qt. 1 pt.

The answer may be found thus:

$$\begin{array}{r} 2)149 \\ \underline{4)74^{1}} \\ 18^{2} \end{array}$$ (read *74 and 1 over*)

Exercise 43

1. Reduce 7 lb. 2 oz. to ounces.
2. Reduce 4 T. 8 cwt. to hundredweight.
3. Reduce 4 da. 8 hr. to hours.
4. Reduce 4 A. 30 sq. rd. to square rods.
5. Reduce 12 gal. 3 qt. to pints.
6. Reduce 2 mi. 18 rd. to rods.
7. Reduce 4 bu. 2 pk. 6 qt. to quarts.
8. Reduce 2 yd. 2 ft. 6 in. to inches.
9. Reduce 18° 14′ to minutes.
10. Reduce 12° 15′ 12″ to seconds.
11. Reduce 148 qt. to bushels, etc.
12. Reduce 131 qt. to gallons, etc.

13. Reduce 426′ to degrees, etc.
14. Reduce 1000 oz. to pounds, etc.
15. Reduce 3675 sec. to hours, etc.
16. Reduce 500 gi. to gallons, etc.
17. Reduce 150 pt. to bushels, etc.
18. Reduce 4875 lb. to tons, etc.
19. Reduce 275 pt. to gallons, etc.
20. Reduce 2000 in. to yd., etc.
21. Reduce 6000″ to degrees, etc.

Addition and Subtraction

57. 1. Find the sum of 4 bu. 3 pk. 2 qt., 3 bu. 1 pk. 5 qt., and 2 bu. 2 pk. 6 qt.

bu.	pk.	qt.
4	3	2
3	1	5
2	2	6
10	3	5

The sum of the quarts is 13 qt., or 1 pk. 5 qt. Write 5 under the quarts and add 1 pk. to the pecks. The sum of the pecks is 7 pk., or 1 bu. 3 pk. Write 3 under the pecks and add 1 bu. to the bushels. The sum of the bushels is 10 bu.

The sum is 10 bu. 3 pk. 5 qt.

2. From 20 yr. 6 mo. 18 da. take 14 yr. 8 mo. 14 da.

yr.	mo.	da.
20	6	18
14	8	14
5	10	4

14 da. from 18 da. leaves 4 da. Write 4 under the days. We cannot take 8 mo. from 6 mo., so we take 1 yr., or 12 mo., from 20 yr. (leaving 19 yr.) and add it to 6 mo., making 18 mo.; 8 mo. from 18 mo. leaves 10 mo. Write 10 under the months. 14 yr. from 19 yr. leaves 5 yr.

The difference is 5 yr. 10 mo. 4 da.

3. George Washington was born Feb. 22, 1732, and died Dec. 14, 1799; to what age did he live?

yr.	mo.	da.
1799	12	14
1732	2	22
67	9	22

He was born on the 22d day of the 2d month of the year 1732, and died on the 14th day of the 12th month of the year 1799.

The difference, or 67 yr. 9 mo. 22 da., was the age to which he lived.

Exercise 44

1. Add:

ft.	in.
3	8
6	9
9	10

2. Add:

T.	cwt.	lb.
2	13	48
1	7	82
2	8	10

3. Add:

yr.	mo.	da.
12	4	6
8	7	20
5	6	12

4. Add:

°	′	″
25	36	42
12	30	26
14	12	14

5. Subtract:

yr.	mo.	da.
1912	6	20
1902	8	24

6. Subtract:

°	′	″
110	20	18
25	40	30

7. In one bag there are 2 bu. 3 pk. of potatoes, and in another 1 bu. 2 pk.; what is the amount of potatoes in the two bags?

8. A keg contained 5 gal. 2 qt. of cider, but 2 gal. 3 qt. have been drawn off; how much remains?

9. A man was born Jan. 12, 1891, and had his life insured on Feb. 9, 1912; how old was he when he had his life insured?

10. Daniel Webster was born Jan. 18, 1782, and died Oct. 24, 1852; how old was he when he died?

11. Henry Clay died June 29, 1852, at the age of 75 yr. 2 mo. 17 da.; when was he born?

12. At Philadelphia, June 19, the sun rose at 4 hr. 28 min. A.M., and set 7 hr. 34 min. P.M. How long was it on that day from sunrise to sunset?

13. A wagon loaded with hay weighed 42 cwt. 40 lb.; the wagon weighed 14 cwt. 80 lb. Find the weight of the hay.

Multiplication and Division

58. 1. Multiply 2 bu. 2 pk. 6 qt. by 5.

bu.	pk.	qt.
2	2	6
		5
13	1	6

5×6 qt. $= 30$ qt., or 3 pk. 6 qt.
5×2 pk. $= 10$ pk.
10 pk. $+ 3$ pk. $= 13$ pk., or 3 bu. 1 pk.
5×2 bu. $= 10$ bu.
10 bu. $+ 3$ bu. $= 13$ bu.
The product is 13 bu. 1 pk. 6 qt.

2. Divide 20 gal. 2 qt. 1 pt. by 3.

gal.	qt.	pt.
3)20	2	1
6	3	1

20 gal. $\div 3 = 6$ gal., and 2 gal. over.
2 gal. 2 qt. $= 10$ qt.
10 qt. $\div 3 = 3$ qt., and 1 qt. over.
1 qt. 1 pt. $= 3$ pt.
3 pt. $\div 3 = 1$ pt.
The quotient is 6 gal. 3 qt. 1 pt.

Exercise 45

1. Multiply 2 ft. 6 in. by 5.
2. Multiply 2 gal. 3 qt. by 5.
3. Multiply 2 bu. 3 pk. by 6.
4. Multiply 2 gal. 1 qt. 1 pt. by 4.
5. Multiply 4 bu. 3 pk. 2 qt. by 5.
6. Multiply 12° 4′ 5″ by 15.
7. Divide 16 gal. 2 qt. by 6.
8. Divide 11 ft. 8 in. by 5.
9. Divide 16 bu. 3 pk. 2 qt. by 5.
10. Divide 39 gal. 1 qt. 1 pt. by 7.
11. Divide 7 gal. 2 qt. by 1 gal. 1 qt.

SUGGESTION. 7 gal. 2 qt. ÷ 1 gal. 1 qt. = 30 qt. ÷ 5 qt. = 30 ÷ 5.

12. Divide 8 ft. 4 in. by 1 ft. 3 in.
13. Divide 10 bu. 2 pk. by 3 bu. 2 pk.
14. Divide 16 ft. 8 in. by 1 ft. 8 in.
15. A dealer bought a tract of land containing 6 A. 120 sq. rd. and divided it into 12 building lots of equal size; find the number of square rods in each lot.
16. How many bags each holding 2 bu. 2 pk. are required to hold 40 bu. of wheat?
17. At 15¢ an hour, how much will a workman earn in a day if he works from 7.30 A.M. till noon and from 1 P.M. till 6.30 P.M.?

REVIEW

Exercise 46

1. A man gained \$2 a head on 30 sheep, which he sold for \$ 210. What was the average cost of the sheep per head?

2. How many cords of wood are there in a pile 32 ft. long, 4 ft. wide, and 4 ft. high?

3. A perch of masonry is a wall $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. thick, and 1 ft. high. How many cubic feet are there in 10 perches?

4. At \$32 per M find the cost of 36 pieces of lumber 18 ft. long, 6 in. wide, and 4 in. thick.

5. Concrete walks with 12 in. of cinders, 3 in. of concrete, and 1 in. of top finish cost about 20¢ per square foot of surface; find the cost, at this estimate, of a concrete walk 30 ft. long and 4 ft. wide.

6. Water boils at 212°, and freezes at 32°, as measured by the thermometer which we commonly use, the Fahrenheit; how many degrees are there between freezing point and boiling point on this thermometer?

7. When a Fahrenheit thermometer registers 0°, how many degrees is it registering below freezing?

8. When a Fahrenheit thermometer registers 40°, how many degrees is it registering above freezing?

9. Render this bill for the month named in the current year. Receipt the bill.

Nov. 11	1 oak sewing table	$6.45
	1 porch swing	5.85
	1 stepladder	.95
Nov. 15	1 stove	18.50
	1 washing machine	6.90

10. How many square yards of plastering are there in the walls and ceiling of a room 21 ft. long, 18 ft. wide, and 9 ft. high, making no allowance for doors and windows?

11. Find the cost of carpeting a room 24 ft. long and 18 ft. wide, with carpet $\frac{3}{4}$ yd. wide, the strips running lengthwise and the carpet surrounded by a border $\frac{3}{4}$ yd. wide, if the carpet cost $1.20 per yard and the border $1 per yard.

12. How many feet are there in a league?

13. How many bushels of potatoes will a bin hold if it is 16 feet long, 10 ft. wide, and 8 ft. deep, estimating that 1 bu. of potatoes is $\frac{25}{16}$ of a cubic foot?

14. At 30¢ per cubic yard for the removal of earth, find the cost of digging a cellar 48 ft. long, 24 ft. wide, and 9 ft. deep.

15. Bran weighs 20 lb. to the bushel; how many bushels are there in a ton of bran?

16. At $32 per 1000 ft. find the cost of 20 pieces of lumber $4'' \times 6'' \times 16'$.

PERCENTAGE

DEFINITIONS AND REDUCTIONS

59. Instead of saying *five hundredths* of a number, we may say **five per cent** of a number.

Per cent means *hundredths.*

Thus, 1 per cent of a number is $\frac{1}{100}$ of it.
4 per cent of a number is $\frac{4}{100}$, or $\frac{1}{25}$, of it.
25 per cent of a number is $\frac{25}{100}$, or $\frac{1}{4}$, of it.
100 per cent of a number is $\frac{100}{100}$, or once, the number.
200 per cent of a number is $\frac{200}{100}$, or twice, the number.
250 per cent of a number is $\frac{250}{100}$, or $2\frac{1}{2}$ times, the number
$12\frac{1}{2}$ per cent of a number is $\frac{12\frac{1}{2}}{100}$, or $\frac{1}{8}$, of it.

60. The sign % stands for per cent.

Thus, *5 per cent of 50* may be expressed *5 % of 50.*

Exercise 47

What part of a number is:

1. 2% of it?
2. 4% of it?
3. 10% of it?
4. 20% of it?
5. 15% of it?
6. 40% of it?
7. 50% of it?
8. 75% of it?
9. 30% of it?
10. 80% of it?
11. 90% of it?
12. 45% of it?

Express as a per cent:

13. $\frac{1}{2}$
14. $\frac{1}{4}$
15. $\frac{1}{5}$
16. $\frac{3}{4}$
17. $\frac{3}{5}$
18. $\frac{4}{5}$
19. $\frac{3}{10}$
20. $\frac{7}{10}$
21. $\frac{3}{2}$
22. $2\frac{1}{2}$
23. $\frac{1}{8}$
24. $\frac{1}{3}$

61. Memorize this **table of equivalents**

$\frac{1}{2} = 50\,\%$	$\frac{1}{5} = 20\,\%$	$\frac{1}{8} = 12\frac{1}{2}\,\%$	$\frac{1}{3} = 33\frac{1}{3}\,\%$
$\frac{1}{4} = 25\,\%$	$\frac{2}{5} = 40\,\%$	$\frac{3}{8} = 37\frac{1}{2}\,\%$	$\frac{2}{3} = 66\frac{2}{3}\,\%$
$\frac{3}{4} = 75\,\%$	$\frac{3}{5} = 60\,\%$	$\frac{5}{8} = 62\frac{1}{2}\,\%$	$\frac{1}{6} = 16\frac{2}{3}\,\%$
$\frac{1}{20} = 5\,\%$	$\frac{4}{5} = 80\,\%$	$\frac{7}{8} = 87\frac{1}{2}\,\%$	$\frac{1}{12} = 8\frac{1}{3}\,\%$

62. The number of which a given per cent is taken is called the **base**. The number of hundredths of the base taken is called the **rate**, and the result obtained by taking a given per cent of the base is called the **percentage**.

FINDING PER CENTS

63. Find 5% of 80:

Thus, 5% of 80 $= \frac{5}{100}$, or $\frac{1}{20}$, of 80, or **4**.

Exercise 48

In Examples 1–21 find:

1. 1% of 200
2. 50% of 12
3. 25% of 8
4. 20% of 35
5. 10% of 70
6. 5% of 80
7. 2% of 150
8. 4% of 100
9. 40% of 15
10. 60% of 50
11. 30% of 30
12. 90% of 90
13. 75% of 24
14. 8% of 50
15. 25% of \$16
16. $12\frac{1}{2}$% of \$0.40
17. 4% of \$200
18. 2% of \$1000
19. 100% of \$2
20. 200% of \$1.50
21. 300% of \$3

22. How much is 20% of $20?

23. How much is 4% of 50¢?

24. A farmer sold 50% of 80 bu. of wheat; how much wheat did he sell?

25. 50% of a bushel is how many pecks?

26. 25% of a gallon is how many quarts?

27. $12\frac{1}{2}\%$ of a pound is how many ounces?

28. $37\frac{1}{2}\%$ of a quire is how many sheets?

29. 75% of $16 is how much money?

30. 80% of a class of 20 pupils is how many pupils?

31. A boy was given 50 words to spell; if he spelled 80% of them correctly, how many did he spell correctly?

32. 75% of a class of 40 pupils was promoted; how many were promoted?

33. A dealer bought a horse for $200 and sold him so as to gain 20% of the cost; what did he receive for him?

34. A farmer's corn crop was 160 bu.; he used $37\frac{1}{2}\%$ of it; how many bushels did he use?

35. A merchant asked $10 for a coat, but sold it at 20% below this price; what did he receive for it?

36. Name at sight the equivalent fractions:

$12\frac{1}{2}\%$; $62\frac{1}{2}\%$; $37\frac{1}{2}\%$; $87\frac{1}{2}\%$; $33\frac{1}{3}\%$; $66\frac{2}{3}\%$.

64. 1. Find 5% of $248.

$$\begin{array}{r} \$248 \\ .05 \\ \hline \$12.40 \end{array}$$

5% of $248 = .05 \times \$248$, or $12.40.

2. Find $66\frac{2}{3}\%$ of 360°.

Thus, $66\frac{2}{3}\%$ of $360° = \frac{2}{3}$ of 360°, or 240.°

Exercise 49

Find:

1. 25% of 286
2. 28% of 360
3. 35% of 742
4. 42% of 810
5. 58% of 724
6. 32% of 890
7. 56% of 638
8. 65% of 318
9. 56% of 832
10. 75% of 856
11. $12\frac{1}{2}\%$ of 16
12. $37\frac{1}{2}\%$ of \$24
13. $62\frac{1}{2}\%$ of 6 A.
14. $87\frac{1}{2}\%$ of 2 yd.
15. $33\frac{1}{3}\%$ of 5280 ft.
16. $66\frac{2}{3}\%$ of 1200 lb.
17. 16% of 120 ft.
18. $12\frac{1}{2}\%$ of 1600 sheep
19. $37\frac{1}{2}\%$ of \$1600
20. $87\frac{1}{2}\%$ of \$3000

21. A lawyer collected \$500, and charged 15% of the sum collected for his services; how much did he charge?

\$5 00	
.15	\$500 = the sum collected.
25 00	15%, or .15, of the sum collected = the charges.
50 0	∴ .15 × \$500, or \$75 = the charges.
\$75.00	

22. A had \$275 in the bank and withdrew 20% of it; how much did he withdraw?

23. A merchant agreed to settle some outstanding bills amounting to \$275 for 80% of their full value; for what sum did he agree to settle?

24. Milk yields butter to the extent of about 4% of its weight; how much butter will 175 lb. of milk yield?

25. 10% of all silver coin is copper; find the weight of the copper in silver coin to the weight of 33 lb.

26. If a farmer had 376 bu. of oats, and sold $87\frac{1}{2}\%$ of it, how much did he sell?

FINDING A NUMBER WHEN A CERTAIN PER CENT OF IT IS GIVEN

65. 2 is 25% of what number?

$2 = \frac{25}{100}$, or $\frac{1}{4}$, of the required number.

$\therefore \frac{4}{4}$ of the required number $= 4 \times 2$, or 8.

Exercise 50

In Examples 1–15 find the number of which:

1. 6 is 50%	2. 8 is 25%	3. 3 is 20%
4. $2\frac{1}{2}$ is 10%	5. 5 is 1%	6. 14 is 200%
7. 4 is 80%	8. 20 is 400%	9. 18 is 60%
10. 36 is 90%	11. 10 is $12\frac{1}{2}\%$	12. 15 is 75%
13. 1.5 is 50%	14. $\frac{3}{5}$ is 60%	15. 8 is $33\frac{1}{3}\%$

16. \$18 is 20 per cent of what sum?

17. \$20 is 80 per cent of what sum?

18. 2 yards is 50% of what length?

19. 2 pounds is 5% of what weight?

20. $\frac{1}{2}¢$ is 50% of what sum?

21. 50¢ is 200% of what sum?

22. 6 feet is 300% of what length?

23. 25 lb. is 200% of what weight?

24. A boy spelled 20 words correctly, which were 80% of the words given him; how many were given him?

25. A man was paid 25% of the sum collected for collecting a bill overdue; he was paid $40. What was the bill?

26. A man sold 40 acres of land, which was 60% of all he had; how much had he?

27. A man sold 80 bu. of grain, which was 80% of his crop; how many bushels were there in his crop?

28. A man lost 12½% of what he paid for an article; if he lost $20, what did he pay for the article?

29. 12 gallons of vinegar leaked away, which was 37½% of what a vessel contained; how many gallons did it contain?

66. 1. If 16% of a number is 80, what is the number?

$$.16\overline{)80.00}$$
$$5\,00$$

.16 × the number = 80

∴ 80 ÷ .16, or 500 = the number.

2. If 66⅔% of a number is 120, what is the number?

66⅔%, or ⅔, of the number = 120.

∴ ⅓ of the number = ½ of 120, or 60.

∴ ⅔ of the number = 3 × 60, or 180.

Exercise 51

In Examples 1–18 find the number of which:

1. 125 is 25%
2. 96 is 50%
3. 144 is 40%
4. 120 is 60%
5. 136 is 75%
6. 210 is 42%

7. 136 is 25%
8. 280 is 70%
9. 480 is 2%
10. 56 is $12\frac{1}{2}$%
11. 36 is $37\frac{1}{2}$%
12. 48 is $62\frac{1}{2}$%
13. 120 is $87\frac{1}{2}$%
14. 48 is $33\frac{1}{3}$%
15. 56 is $66\frac{2}{3}$%
16. 85 is $16\frac{2}{3}$%
17. 48 is $2\frac{1}{2}$%
18. 93 is $37\frac{1}{2}$%

19. A dealer bought a lot for \$306 which was 15% of the cost of the house he built on it; find the cost of the house.

$$.15)\overline{\$\ 306.00}\quad \$\ 2040$$

.15 × the cost of the house = the cost of the lot.
∴ the cost of the house = the cost of the lot ÷ .15.
∴ \$306 ÷ .15, or \$2040 = the cost of the house.

20. A merchant failing in business paid 75% of his debts; if he paid \$360, what were his debts?

21. If milk yields 4% of its weight of butter, how many pounds of milk will yield 150 lb. of butter?

22. The width of a field is 180 rd., which is 75% of its length; find its length.

23. 65% of a man's land is farm land and the remainder woodland; if he has 260 acres of farm land, how many acres are there in the farm? how many acres of woodland?

24. 85% of the children of a certain grade were promoted; if 340 were promoted, how many children were there in the grade?

25. A farmer sold 437.5 bu. of wheat, which was $87\frac{1}{2}\%$ of his wheat crop; find his wheat crop.

SUGGESTION.—$87\frac{1}{2}\%$ of his crop = .875 × his crop.

26. A clerk's expenses were \$540, which was $62\frac{1}{2}\%$ of his earnings; what were his earnings?

FINDING WHAT PER CENT ONE NUMBER IS OF ANOTHER

67. 8 is what per cent of 20?

$8 = \frac{8}{20}$, or $\frac{2}{5}$, of 20.

$\therefore 8 = \frac{2}{5}$ of 100% of 20, or 40% of 20.

Exercise 52

In Examples 1–15 state what per cent:

1. 2 is of 4	2. 3 is of 5	3. 1 is of 10
4. 25 is of 75	5. 2 is of 50	6. 5 is of 100
7. 6 is of 30	8. 5 is of 200	9. 4 is of 2
10. 9 is of 9	11. 40 is of 50	12. 60 is of 80
13. $\frac{1}{2}$ is of 1	14. $2\frac{1}{2}$ is of 5	15. $\frac{1}{4}$ is of $\frac{1}{2}$

16. 1¢ is what per cent of 2¢?

17. 2¢ is what per cent of 5¢?

18. 1 quart is what per cent of a gallon?

19. 1 peck is what per cent of a bushel?

20. 1 quart is what per cent of a peck?

21. 1 cent is what per cent of a dime?

22. A quarter dollar is what per cent of a dollar?

23. 2 × any number is how many per cent of it?

24. 3 × any number is how many per cent of it?

25. 5 × any number is how many per cent of it?

26. $2\frac{1}{2}$ times any number is how many per cent of it?

27. 2 is what per cent of 1?

28. 4 is what per cent of 1?

29. 10 is what per cent of 5?

30. 5 is what per cent of 2?

31. A laborer's wages were increased from \$10 to \$12 a week; find the per cent of increase.

32. What per cent should a girl receive who spells correctly 20 words of the 25 given?

33. A boy attended school 15 days out of 20 during a certain month; find the per cent of his attendance.

68. 1. 48 is what per cent of 240?

$$2.40\overline{)48.0}$$
$$20$$

.01 of 240 = 2.40.

48 ÷ 2.4, or 20 = the required number of per cent.

2. From a 48-gallon barrel of vinegar a merchant sold 12 gallons; what per cent of the vinegar did he sell?

12 gal. = $\frac{1}{4}$ of 48 gal.

∴ $\frac{1}{4}$ of 100 %, or 25 %, is the required per cent.

Exercise 53

In Examples 1–16 find what per cent:

1. 140 is of 560
2. 180 is of 450
3. 22.8 is of 456
4. 14 is of 175

5. 250 is of 2000
6. 28 is of 200
7. 20 is of 160
8. 60 is of 180
9. 90 is of 270
10. 270 is of 720
11. 1000 is of 800
12. 5.12 is of 256
13. $240 is of $1200
14. $4.80 is of $160
15. $180 is of $270
16. $8.20 is of $820

17. A clerk who earned $640 a year paid $96 a year for house rent; what per cent of his salary did he pay for house rent?

$$\begin{array}{r} 6.40\overline{)96.0(15} \\ \underline{64} \\ 320 \\ \underline{320} \end{array}$$

$640 = his salary.
.01 of $640, or $6.40 = the rent, if it were 1 % of the salary.
∴ 96 ÷ 6.40, or 15 = the number of per cent required.

18. A merchant bought a bill of goods amounting to $360 and paid $90 on the bill; what per cent of it did he pay?

19. If in 300 lb. of corn there are 16.2 lb. of fat, what is the per cent of fat in corn?

20. A marketman sold for a merchant $78 worth of poultry, charging $3.90 for making the sale; what per cent of the selling price was charged?

21. A lawyer collected a debt of $1200, charging $150 for making the collection; what per cent of the debt did he charge?

COMMERCIAL DISCOUNT

Definitions

69. Commercial discount, or **trade discount,** is any deduction from the *list price,* the *time price,* or the *marked price* of goods.

If but one discount is made on any price, a certain per cent of that price is deducted; if two discounts are made, the first is reckoned on the price, the second on the remainder.

Thus, if an article is marked at \$0.80 and sold at a discount of 10 %, the discount is 10 % of \$0.80 or \$0.08. If an article is marked at \$2.00 and sold at a discount of 20 % and $12\frac{1}{2}$ %, the first discount is 20 % of \$2.00, or \$0.40; the second discount is $12\frac{1}{2}$ % of \$1.60 or \$0.20. The total discount is \$0.60, and the **net cost** \$1.40.

Finding the Discount and Net Cost

Exercise 54

Fill in at sight the missing discounts:

	Marked Price	Rate of Discount	Discount
1.	\$20	50 %	?
2.	\$50	20 %	?
3.	\$75	20 %	?
4.	\$25	40 %	?
5.	\$30	60 %	?
6.	\$42	$33\frac{1}{3}$ %	?
7.	\$30	$37\frac{1}{2}$ %	?
8.	\$64	$12\frac{1}{2}$ %	?
9.	\$3.20	25 %	?

70. 1. Find the net cost of a bill of goods amounting to $210 and sold at a discount of 15 %.

$210 = the amount of the bill.

$$\begin{array}{r} .15 \\ \hline 1050 \\ 210 \\ \hline \$31.50 \end{array}$$

= the discount.

∴ $210 − $31.50, or $178.50 = the net cost of the bill.

2. What must be paid for a safe listed at $200 and bought at 25 % and 10 % off?

25 %, or ¼, of $200, or $50 = the first discount.
∴ $200 − $50, or $150 = the first remainder.
10 % of $150, or $15 = the second discount.
And, $150 − $15, or $135 = the cost.

Exercise 55

1. Find the net cost of a bill of goods amounting to $260 on which there was a discount of 5 % allowed.

2. What was the net cost of a rug marked $26 and sold at a discount of 16 %?

3. What was the net cost of a bill of hardware amounting to $175 and bought at a discount of 20 %?

4. What was the net cost of a bill of furniture amounting to $160 and bought at a discount of 25 % and 20 %?

5. What was the net cost of an automobile listed at $1600 and sold at a discount of 25 % and 20 %?

6. What was the net cost of a piano listed at $800 and sold at a discount of 25 % and 33⅓ %?

Find the net cost of the following bills of goods sold subject to the discounts shown:

	Amount of Bill	Discount	Net Cost
7.	$450	15%	?
8.	$275	25%	?
9.	$420	12½%	?
10.	$560	50% and 20%	?
11.	$540	50% and 10%	?

PROFIT AND LOSS

Finding the Gain, Loss, and Selling Price

71. Gain or loss per cent is always reckoned on the cost.

Exercise 56

Supply the missing gains and losses in Examples 1–10:

	Cost	Gain Per Cent	Loss Per Cent	Gain	Loss
1.	$20	50%		?	
2.	$10		25%		?
3.	$15	33⅓%		?	
4.	$24		37½%		?
5.	$32		62½%		?
6.	$40	12½%		?	
7.	$56	87½%		?	
8.	$60	100%		?	
9.	$80		1%		?
10.	$100		2%		?

11. A pair of shoes that cost \$2 was sold at a profit of 25%; find the selling price.

12. A grocer sold coffee that cost 30¢ a pound at a gain of 20%; find the selling price.

13. What was the selling price of tea that cost 50¢ a pound if it was sold at a profit of 20%?

14. What was the selling price of a house that cost \$2000 if it was sold at a profit of 50%?

15. What must be the selling price of sugar that cost 6¢ a pound in order that it may be sold at a profit of $33\frac{1}{3}$%?

16. What was the selling price of oranges that cost 20¢ a dozen and were sold at a profit of 40%?

17. An article that cost 6¢ was sold at a loss of $33\frac{1}{3}$%; what was the selling price?

18. What was the selling price of an article that cost \$120 and was sold at a loss of 25%?

19. What was the selling price of an article that cost 1¢ and was sold at a profit of 100%?

20. What was the selling price of an article that cost 3¢ and was sold at a profit of 300%?

72. 1. Find the selling price of an article that cost \$56 if it was sold at a loss of 4%.

\$56 = the cost.
.04
\$2.24 = the loss.

∴ \$56 − \$2.24, or \$53.76 = the selling price.

2. Find the selling price of an article that cost \$144 if it was sold at a profit of $12\frac{1}{2}\%$.

\$144 = the cost.
$12\frac{1}{2}\%$, or $\frac{1}{8}$, of the cost = the gain.
$\therefore \frac{1}{8}$ of \$144, or \$18 = the gain;
and, \$144 + \$18, or \$162 = the selling price.

Exercise 57

1. Find the selling price of a machine that cost \$150 if it was sold at a profit of 35%.

2. Find the selling price of a horse that cost \$150 if it was sold at a loss of 32%.

3. Find the selling price of a wagon that cost \$145 if it was sold at a profit of 28%.

4. Find the selling price of a quantity of coal bought for \$275 and sold at a profit of $37\frac{1}{2}\%$.

5. Find the selling price of a house and lot that cost \$3750 and were sold at a profit of $12\frac{1}{2}\%$.

Find the gain and selling price if the cost is:

6. \$500, and the rate of gain 28%.

7. \$488, and the rate of gain $12\frac{1}{2}\%$.

8. \$630, and the rate of gain $66\frac{2}{3}\%$.

9. \$1000, and the rate of gain 100%.

10. \$275, and the rate of gain 1%.

11. \$286, and the rate of gain 10%.

Find the loss and selling price if the cost is:

12. $650, and the rate of loss 32%.
13. $460, and the rate of loss 25%.
14. $496, and the rate of loss 55%.
15. $222, and the rate of loss $33\frac{1}{3}$%.
16. $500, and the rate of loss 1%.
17. $1000, and the rate of loss 50%.

Finding the Rate Per Cent of Gain or Loss

Exercise 58

In each of the following exercises supply at sight the missing rate per cent of gain.

	Cost	Gain	Rate Per Cent of Gain
1.	2¢	1¢	?
2.	10¢	1¢	?
3.	25¢	5¢	?
4.	50¢	10¢	?
5.	60¢	20¢	?
6.	80¢	10¢	?
7.	$2	$2	?
8.	$4	$1	?
9.	$15	$5	?
10.	$25	$1	?
11.	$30	$20	?
12.	$40	$30	?

In each of the following exercises supply at sight the missing rate per cent of loss.

	Cost	Loss	Rate Per Cent of Loss
13.	2¢	1¢	?
14.	3¢	1¢	?
15.	4¢	2¢	?
16.	5¢	2¢	?
17.	10¢	4¢	?
18.	12¢	4¢	?
19.	15¢	10¢	?
20.	18¢	6¢	?
21.	20¢	1¢	?
22.	25¢	4¢	?
23.	50¢	40¢	?
24.	75¢	25¢	?
25.	80¢	10¢	?

73. 1. An article was bought for \$ 48 and sold for \$ 60; find the gain per cent.

\$ 60 = the selling price.
\$ 48 = the cost.
∴ \$ 12 = the gain.
∴ ¼ of the cost = the gain.
Then ¼ of 100 %, or 25 % = the rate of gain.

2. An article was bought for \$ 130 and sold for \$ 136.50, find the gain per cent.

\$ 136.50 = the selling price.
\$ 130 = the cost.
\$ 6.50 = the gain.
1 % of \$ 130 or \$ 1.30 = the gain at 1 %.
6.50 ÷ 1.30, or 5 = the number of per cent gained.

Exercise 59

Find the gain or loss per cent:

1. If the cost is $250 and the gain is $50.
2. If the cost is $160 and the gain is $19.20.
3. If the cost is $150 and the gain is $22.50.
4. If the cost is $565 and the loss is $113.
5. If the cost is $200 and the selling price is $250.
6. If the cost is $400 and the selling price is $450.
7. If the cost is $500 and the selling price is $440.
8. If the cost is $800 and the selling price is $775.
9. If an article is bought for $180 and sold for $120.
10. If an article is bought for $250 and sold for $275.

COMMISSION

Definitions

74. **Commission** is the sum charged by one person for transacting business for another. It is a certain per cent of the money involved in the transaction.

75. When a **sale** is made, *commission is reckoned on the amount of sales;* when a **purchase** is made, *commission is reckoned on the amount of the purchase.*

Thus, if an agent sells goods to the amount of $300 on a commission of 4 %, his commission is 4 % of $300, or $12. If an agent purchases goods to the amount of $200 on a commission of 2 %, his commission is 2 % of $200, or $4.

76. The **net proceeds** is the sum left after the commission and other expenses have been paid.

Finding Commission, Net Proceeds, and Net Cost

Exercise 60

In the following exercises supply at sight the missing amounts:

	Sales	Rate of Commission	Commission	Net Proceeds
1.	$50	10 %	?	?
2.	$100	5 %	?	?
3.	$40	20 %	?	?
4.	$80	25 %	?	?
5.	$10	10 %	?	?
6.	$8	$12\frac{1}{2}$ %	?	?
7.	$12	$33\frac{1}{3}$ %	?	?
8.	$100	1 %	?	?
9.	$500	2 %	?	?
10.	$16	$37\frac{1}{2}$ %	?	?

In the following exercises supply at sight the missing amounts:

	Amount of Purchase	Rate of Commission	Commission	Entire Cost
11.	$10	10 %	?	?
12.	$50	20 %	?	?
13.	$40	25 %	?	?
14.	$80	5 %	?	?
15.	$8	$12\frac{1}{2}$ %	?	?
16.	$16	$37\frac{1}{2}$ %	?	?
17.	$30	$33\frac{1}{3}$ %	?	?
18.	$200	1 %	?	?

77. 1. Find the net proceeds of a sale of goods, amounting to $ 275, after an agent has deducted a commission of 4 % and paid freight charges amounting to $ 4.50.

$ 275 = the sales.
.04
$ 11.00 = the commission.
4.50 = the freight charges.
$ 15.50 = the total expenses.

∴ $ 275 − $ 15.50, or $ 259.50 = the net proceeds.

2. My agent purchased for me grain to the amount of $ 525. If he charged me 4 % commission, and prepaid freight amounting to $ 5.75, what was the entire cost of the grain?

$ 525 = the amount of the purchase.
.04
$ 21.00 = the commission.
5.75 = the freight charges.
525.00 = the amount of the purchase.
$ 551.75 = the entire cost.

Exercise 61

1. An agent sold grain to the amount of $ 280 and charged a commission of 4 % ; find the net proceeds.

2. Find the net proceeds of a sale of $ 360 worth of baled hay after a commission of 6 % was deducted.

3. Find the entire cost of a house purchased for $ 2000 if an agent was paid 5 % for making the purchase, and there were other charges amounting to $ 37.50.

4. Find the net proceeds of a sale of poultry amounting to $ 275 after a commission of 8 % was deducted and $ 12.75 for other expenses.

5. A clerk receives $ 3 a week and 2 % commission on all the goods he sells; how much does he earn in a week in which his sales amount to $ 386?

6. An agent sold a machine for $ 275; he charged a commission of 5 % and paid $ 8.75 storage on the machine. How much should he send the owner?

7. Find the net proceeds of a sale of 250 barrels of apples at $ 1.75 a barrel, if the rate of commission was 15 % and storage charges amounted to $ 5.80.

8. Find the net proceeds of a sale of 1840 lb. of butter at 30¢ a pound, if the rate of commission was $12\frac{1}{2}$ % and other charges amounted to $ 15.50.

9. Find the net proceeds of a sale of 2846 lb. of dressed turkey at 15¢ a pound, if the rate of commission was 6 % and cold storage charges amounted to $ 4.50.

10. An agent purchased 200 barrels of flour at $ 9.60 a barrel, charged a commission of 5 %, and prepaid freight amounting to $ 23.52; what was the total cost?

11. Find the entire cost of 400 bu. of wheat at $ 1.05 per bushel, the rate of commission being 2 % and other charges amounting to $ 8.75.

12. A book agent received a salary of $ 50 a month and 15 % of the sales; how much did he earn during a month in which his sales amounted to $ 312?

INTEREST

Definitions

78. If a person borrows money, he usually has to pay a certain per cent of the sum borrowed for the use of it each year.

79. Money paid for the use of money is called **interest.** The sum on which interest is paid is called the **principal.**

Thus, if a man borrows \$100 for 2 years and has to pay 5% of this sum for the use of it each year, he must pay 2 times 5% of \$100, or \$10, for the use of it for 2 years. Here \$10 is the *interest* and \$100 the *principal.*

Exercise 62

What is the interest on:

1. \$100 for 1 yr. at 6%?
2. \$200 for 1 yr. at 5%?
3. \$600 for 2 yr. at 4%?
4. \$300 for 3 yr. at 6%?
5. \$100 for $2\frac{1}{2}$ yr. at 4%?
6. \$500 for $2\frac{1}{2}$ yr. at 6%?
7. \$250 for $\frac{1}{2}$ yr. at 4%?
8. \$800 for $1\frac{1}{4}$ yr. at 4%?
9. \$600 for $2\frac{2}{3}$ yr. at 3%?
10. \$600 for 1 mo. at 6%?

80. The time for which interest is paid is usually reckoned in *years and days, when it exceeds a year; and in days only when it is less than a year, the exact number of days being counted.*

Thus, if a sum of money is on interest from Jan. 2, 1912, to March 1, 1914, the time is counted as follows: from Jan. 2, 1912, to Jan. 2, 1914, is 2 yr.; and from Jan. 2, 1914, to Mar. 1, 1914, is 58 da., making in all 2 yr. 58 da. Again, if a sum of money is on interest from Mar. 1, 1914, to Oct. 1, 1914, the time is 214 da.

81. Interest for time less than a year is usually reckoned on the basis of 360 da. to the year.

Thus, in reckoning interest on a sum for 108 da., the time is usually regarded as $\frac{108}{360}$ yr.

82. Find the interest on \$175 from May 1, 1911, to Sept. 1, 1913, at 4%.

	The time from May 1, 1911, to May 1, 1913
\$ 175	$= 2$ yr.
\$ .04	The time from May 1, 1913, to Sept. 1, 1913
\$ 7.00	$= (30 + 30 + 31 + 31 + 1)$ da. $= 123$ da.
$2\frac{41}{120}$	$\therefore$ The time the principal is on interest
\$ 14.00	$= 2$ yr. 123 da. $= 2\frac{41}{120}$ yr.
$2.39\frac{1}{6}$	$.04 \times \$175$, or \$7 = the interest for 1 yr.
\$ 16.39$\frac{1}{6}$	$2\frac{41}{120} \times \$7$, or \$16.39$\frac{1}{6}$, or \$16.39 = the required interest.

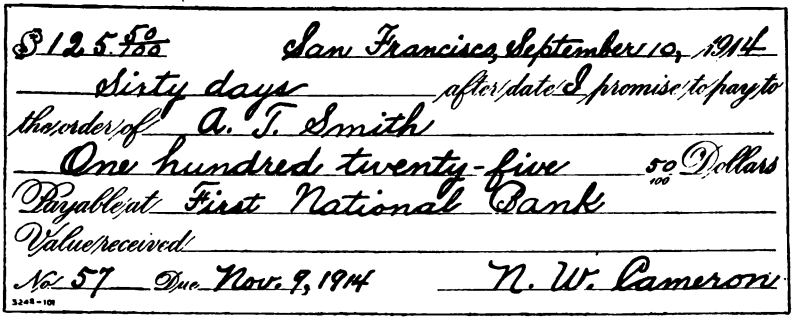
Exercise 63

Find the interest on:

1. \$50 for 3 years at 5%.
2. \$75 for 3 years at 4%.
3. \$260 for 3 years at 3%.
4. \$380 for 4 years at $2\frac{1}{2}$%.
5. \$350 for 90 days at 3%.
6. \$275 for 120 days at 4%.
7. \$418 for 270 days at 5%.
8. \$150.60 for 200 days at 4%.
9. \$85.60 for 3 yr. 20 da. at $4\frac{1}{2}$%.
10. \$145 from Sept. 15, 1912, to Dec. 1, 1913, at 5%.
11. \$875.75 from May 1, 1913, to Dec. 31, 1913, at 5%.

BUSINESS PAPERS

A Promissory Note


$125.50 San Francisco, September 10, 1914

Sixty days after date I promise to pay to the order of A. T. Smith

One hundred twenty-five 50/100 Dollars

Payable at First National Bank

Value received

No. 57 Due Nov. 9, 1914 N. W. Cameron

3248-101

83. A **promissory note** is a written promise to pay a specified sum of money to a certain party at a certain time.

84. The **maker** of a promissory note is the party who signs it and thereby promises to pay. The **payee** is the party whose name is written in the body of the note and to whom the promise to pay is made. The **face** is the amount named in the note.

Thus, in the note on this page, N. W. Cameron is the *maker*, A. T. Smith the *payee*, and $125.50 the *face*.

NOTE 1. — A note may be written so as to include the payment of interest.

NOTE 2. — If a note is payable a certain number of days after date, it is due at the expiration of that number of days after date, not counting the date.

Thus, a note payable 60 da. after June 1 is due July 31.

NOTE 3. — If a note is payable a certain number of months after date, calendar months are to be counted.

Thus, a note payable 2 mo. after June 1 is due August 1.

A Check

THE FIRST NATIONAL BANK OF BOSTON

Boston, Mass. Sept. 4, 1912. No. 247

PAY TO THE ORDER OF John P. Baker $55 00/100

Fifty-five 00/100 Dollars

John K. Wilson

85. A check is a written order by which a bank is directed by a depositor to pay out money belonging to him.

86. The holder of a check should have it cashed on the day he receives it, or on the first business day following.

87. Before the holder of a check has it cashed he must write his name across the back of it. This is called *indorsing* the check.

Indorsement

John P. Baker

A Receipt

Boston, October 4, 1914

Received from Arthur Gordon

Fifty-five 60/100 Dollars

in full of all accounts to date

$55 60/100 Samuel Ward Company

88. A **receipt** is a written acknowledgment of money or goods received, or of services rendered.

NOTE. — When the money paid is only part of the debt owed, "*on account*" should be written in the receipt instead of "*in full of all accounts to date.*"

Exercise 64

1. When is a note due that is dated June 1 and is payable in 90 days?

2. When is a note due that is dated July 15 and is payable in 90 days?

3. When is a note due that is dated Dec. 1, 1912, and is payable in 60 days?

4. When is a note due that is dated Feb. 1 and is payable in 3 months?

5. When is a note due that is dated Feb. 28 and is payable in 2 months?

6. Who is expected to pay the note on page 269 when it is due?

7. Write a promissory note for $10 with yourself as maker, and William Brown as payee. Date the note June 1 of last year and make it payable in 90 days.

8. Suppose you buy a bill of goods from J. L. White for $20.75 payable in 6 months; write the promissory note that you could give him in payment.

9. Suppose you have money deposited in the Central National Bank of Wilmington, Del.; write the check with which you could pay J. L. Williams $5. Who must indorse this check before it is cashed?

10. Write a receipt showing that C. J. Carroll has paid you $25 in full of all accounts to date.

11. Write a receipt showing that J. L. Long paid you to-day $75 on account.

12. Write a receipt for $40 wages that were due you for the month of June, 1912, from L. M. Haines, and paid the last day of that month.

13. Write a promissory note dated at your place of residence June 1 of the current year and payable in 90 days. Make yourself the payee of this note, and George Wilson the maker.

14. Find the interest due on a promissory note for $500, dated June 1 and paid December 15, interest 6 %.

15. A note for $200 was dated March 1 and paid with interest at 5 % October 15; how much was paid on that date?

16. Suppose you have money deposited in the Merchants National Bank of Dayton, Ohio. Write the check with which you could pay L. T. Brown $10.45. Who must indorse this check before L. T. Brown can have it cashed?

17. Write a receipt showing that you paid George Robb in full for 120 bu. of wheat at $0.95 per bushel.

18. Write a promissory note dated at your place of residence, February 1st of last year and payable in 6 months at a national bank near your home. Make John Clark the payee of this note and yourself the maker. Find when the note is due.

REVIEW

Exercise 65

1. A piece of cloth 20 yd. long shrank 20% of its length; how long was it then?

2. A fowl that weighed $12\frac{3}{4}$ lb., weighed when dressed only $66\frac{2}{3}\%$ as much; what was its dressed weight?

3. What is 1% of \$2745?

4. \$100 is 1% of what sum?

5. A dealer sold goods for 80% of the asking price; if he received \$160 for them, what was the asking price?

6. A dealer that bought spices for 40¢ per pound and sold them for 5¢ per ounce gained what per cent?

7. When \$12.50 is gained on \$100, what is the gain per cent?

8. Find $12\frac{1}{2}\%$ of a long ton.

9. A dealer asked \$12 for an article, but sold it for \$9; what was the rate per cent of reduction?

10. A merchant was able to collect only 70% of outstanding bills amounting to \$275.60; how much did he lose?

11. Find the interest on \$275 from June 1 to December 15 at 4%.

12. The population of a certain town was 15,000. If it increased 1% during the next ten years, what was it then?

13. Wood ashes are about 5% potash; find the weight of the potash in a ton (2000 lb.) of wood ashes.

14. An agent bought 1000 bu. of corn at $0.60 per bushel, charging a commission of 2%. What was the entire cost of the corn?

15. If a customer paid 20% of the amount of his bill by paying $18.50, how much was his bill?

16. If a merchant buys cloth at $1.20 per yard, at what price must he sell it to gain $12\frac{1}{2}$%?

17. A clerk was receiving a salary of $800 per year; if it was increased 8%, what was it then?

18. A dealer sold a house for $3000 that cost him $2500; what was his gain per cent?

19. What is the per cent of gain on goods that cost $12 and which were marked $20, but sold at a discount of 25% from the marked price?

20. Find the selling price of shoes marked $3.60, but sold at a discount of 20% and 10% from the marked price.

GENERAL REVIEW

1. Write $7\frac{3}{4}$ million in figures.

2. How much has a man left out of \$1000 after paying two bills, one of \$275.50 and the other of \$185?

3. A man bought 20 cows at \$40 a head and sold 10 of them at \$45 a head; what average price must he receive for the remainder of them to gain \$250 on the transaction?

4. What is the dividend if the divisor is 25, the quotient 25, and the remainder 20?

5. What is the least number that any of the numbers, 2, 3, 4, 5, or 6 will exactly divide?

6. Find the wages due for six days' work of $12\frac{1}{2}$ hours per day, if the wages paid were \$0.37$\frac{1}{2}$ per hour.

7. What number multiplied by 1.2 will produce 17.28?

8. What time elapses from 7.30 P.M. Thursday till 1 P.M. Friday?

9. What is the least sum that can be paid either in \$10 bills, \$20 bills, or \$50 bills?

10. The wage rate of men on farms in Michigan, in a recent year, was \$29.37 per month without board, and \$21.57 per month with board; what was the estimated value of board per year?

11. How many acres are there in a tract of land 2 mi. square?

12. Under ordinary conditions of weather and soil, cabbage will yield 15,000 lb. to the acre; how many acres should yield 20 T.?

13. Find a grocer's gain on 100 lb. of sugar bought at $5\frac{3}{8}¢$ a pound and retailed at $6¢$ a pound.

14. A tank weighing 785 lb. and holding 750 gal. is full of water; find the total weight, water weighing about $8\frac{1}{3}$ lb. per gallon.

15. If a man's income is \$1500 for a year and his expenses are \$875, what are his average savings per month?

16. Water weighs 62.5 lb. per cubic foot, and silver is 10.47 times as heavy as water; what does a cubic foot of silver weigh?

17. A farmer planted 12.5 bu. of seed and the yield was 378.125 bu. of grain; what was the yield for each bushel sowed?

18. Express each of the following as a decimal part of a dollar, and find their sum: 12.5 cents, 18.75 mills, 1.75 cents, 14 cents, 6.5 mills, and $\$\frac{1}{2}$.

19. If a rectangular piece of land 44 yd. long and 40 yd. wide produced 312 lb. of wheat, what was the yield per acre at this rate, wheat weighing 60 lb. per bushel?

20. The sum of two numbers is 26, their difference is 6; what are the numbers?

SUGGESTION. — $2 \times$ the smaller number $+ 6 = 26$.
$2 \times$ the smaller number $= 20$.

21. In what time should 8 men finish a piece of work $\frac{3}{4}$ of which 4 men have done in 6 da.?

22. A dealer bought a bushel of chestnuts for $2.50. They shrunk 1 qt. before they were sold; what was his profit on the bushel, if he retailed them at 12¢ a quart?

23. Simplify: $\frac{.001 \div .1}{.01 \div 10}$.

24. The average yield of hay per acre in Michigan is 1.46 T.; how many pounds is this?

25. Sand weighs about 133 lb. per cubic foot; estimating a bushel to be $\frac{5}{4}$ of a cubic foot, what should a bushel of sand weigh?

26. Find the cost of cementing a cellar 36 ft. long and 24 ft. wide at $1.50 per square yard.

27. How many seconds are there in a day?

28. What should be charged for 720 lb. of coal at $7.50 per short ton?

29. 90 days after July 15, comes on what date?

30. Ten eggs are estimated to weigh a pound; at this estimate what should be the weight of 5 doz. eggs?

31. How much is the postage on a book weighing $7\frac{1}{2}$ oz., the rate being 1¢ for each 2 oz. or fraction thereof?

32. How much is received for a bushel of plums sold at the rate of 2 qt. for 25¢?

33. A dealer gained twice the cost of spices by selling them at 5¢ an ounce; what did they cost him per pound?

34. A thousand shingles require about $3\frac{1}{2}$ lb. of four-penny nails. At this estimate, what weight of nails would 25,000 shingles require?

35. A farmer sold 2116 lb. of wheat at \$0.96 per bushel (60 lb.); how much did he receive for it?

36. If 9 bu. of apples of average quality will make a barrel of $31\frac{1}{2}$ gal. of cider, how many bushels of apples of the same quality will make a barrel of 42 gal. of cider?

37. Estimating that ice is $\frac{10}{11}$ as heavy as water and that water weighs 62.5 lb. per cubic foot, find the weight of a block of ice $5\frac{1}{2}$ ft. $\times$ 2 ft. $\times$ 18 in.

38. I have ten dollars in 5-cent pieces; how many 5-cent pieces have I?

39. Find the cost of 360 cabbage plants at \$1.75 per hundred.

40. Find the cost of 271 lb. of old iron at 40¢ per hundredweight.

41. When a Fahrenheit thermometer registers 2° below zero, how many degrees is it registering below freezing?

42. Find the cost of sawing 27,560 ft. of lumber at \$ 6 per 1000 ft.

43. What is the cost of a load of hay weighing 2765 lb. at \$16 per ton?

44. How many cords of wood are there in a pile 36 ft. long, 4 ft. wide, and 4 ft. high?

45. A laborer's wages for a month were \$45. He spent $\frac{5}{8}$ of it and saved the remainder; how much did he save?

46. A dealer paid $240 for a ton of cheese, and retailed it at 16¢ per pound. Find his profit.

47. Simplify: $\frac{.3\frac{1}{3} \div .66\frac{2}{3}}{.37\frac{1}{2} \div 1.5}$.

48. Find the value of 61 lb. 4 oz. of butter at 40¢ a pound.

49. The average yield per acre of hay in Wisconsin is 3600 lb. How many tons should a 10-acre field yield?

50. Find the cost of a piece of linoleum 4 yd. long and 12 ft. wide at 39¢ per square yard.

51. When 40¢ interest is charged for the use of $100 for one month, what should be charged for the use of $1000 for one year?

52. In a recent World's Championship Series in baseball $\frac{3}{5}$ of $147,572.28 was divided equally among 22 players of the winning team. Find correct to the nearest cent how much each of these players received.

53. What is the weight of the water in a tank 6 ft. long and 4 ft. wide if the depth of the water is 1.5 ft., water weighing 62.5 lb. per cubic foot?

54. Find the value of 31 lb. 12 oz. of beef at 16¢ per pound.

55. A dealer bought 200 bu. of clover seed at 7\frac{1}{2}$ a bushel and sold it at a profit of $200; what did he receive for it per bushel?

56. How many yards of carpet must be bought to carpet a room 20 ft. long and 14 ft. wide, if the strips, which are $\frac{3}{4}$ of a yard wide, are to be laid lengthwise and $\frac{1}{2}$ yd. is to be allowed on each strip for waste in matching?

57. Find the cost of two hams at 16¢ a pound, one weighing 12 lb. 9 oz. and the other 14 lb. 11 oz.

58. A man receives $\$\frac{2}{5}$ an hour and during a certain week puts in time as follows: Monday, $7\frac{1}{2}$ hr.; Tuesday, 8 hr.; Wednesday, $8\frac{1}{2}$ hr.; Thursday, 10 hr.; Friday, $12\frac{1}{2}$ hr.; Saturday, 6 hr.; what does he receive that week?

59. A certain horse is $15\frac{3}{4}$ hands high; express this height in feet and inches.

60. A dealer marked a hat to gain 50¢, but he finally sold it for \$1.75 which was at a loss of 25¢; find the marked price.

61. A farmer wishes to sow fertilizer on his land to the amount of 400 lb. per acre. How much should he sow on a piece of land 55 rd. long and 16 rd. wide?

62. Find the cost of 8 planks, 16 ft. × 8 in. × 3 in. at \$ 20 per 1000 feet.

63. If a piece of land 80 yd. long and 22 yd. wide produced 22 bu. of oats, what was the yield per acre?

64. A miller, that returns 42 lb. of flour for every bushel (60 lb.) of wheat ground, should receive how many bushels of wheat, that weigh only 56 lb. per bushel, in return for 1 barrel of flour (196 lb.)?

65. Simplify: $116 \times 4 + 8 - 84 + 12 \times 3 + 63 + 9 \times 7$.

66. If the perimeter of a rectangular piece of land 12 rd. long is 40 rd., what part of an acre does the piece of land contain?

67. How many gallons does a tank hold if it is 7 ft. long, $5\frac{1}{2}$ ft. wide, and 6 ft. deep?

68. Susquehanna granite is 2.704 times as heavy as water, which weighs 62.5 lb. per cubic foot. Find the weight of a block of granite 6 ft. by $1\frac{1}{2}$ ft. by 1 ft.

69. How many 2-inch cubes can be cut from a block of wood in the form of a rectangular solid 8 in. $\times$ 6 in. $\times$ 4 in.?

70. An article sold for 40¢; if the gain on it was four times the cost, what was the gain?

71. Write according to the Roman system the smallest number possible with C, X, V, and I.

72. In a period of eight years recently, tomatoes have advanced from 8¢ a can to 12¢; find the per cent of advance.

73. Find the gain per cent on an article bought for \$ 2000 and sold for \$ 2220.

74. Find the loss per cent on an article sold for \$ 950, which was at a loss of \$ 50.

75. Draw a rectangle 1 ft. 8 in. $\times$ 8 in. Shade $37\frac{1}{2}\%$ of it.

76. How many cards 4 in. $\times$ 2 in. can be cut from a cardboard 3 ft. $\times$ 2 ft.?

77. Find the gain per cent on an article sold for $625, which was at a gain of $125.

78. Find the cost of plastering the walls and ceiling of a room 24 ft. long, 18 ft. wide, and 10 ft. high at 25¢ per square yard, allowing 420 sq. ft. for doors and windows.

79. A man has $4000 in the bank; if he earns $500 a year and spends $750 a year, in how many years will all his money be gone?

80. A consignment of 500 bbl. of beef, each barrel weighing 200 lb., weighs how many tons?

81. A dealer sells oranges at 30¢ a dozen and thereby gains 25% of the cost; find the gain.

82. What was the discount on a bill of shoes amounting to $325, on which discounts of 20% and 10% were allowed?

83. How many leap years are there between 1900 and 1950?

84. Find how many bushels of wheat a bin 6 ft. × 4 ft. × 4 ft. will hold, estimating that a bushel of wheat occupies about $\frac{5}{4}$ of a cubic foot.

85. Find the net proceeds of a sale of $1200 worth of grain if the rate of commission charged for selling it was 2% and the agent paid other expenses amounting to $54.

86. A triangle whose base is 20 rd. and altitude 10 rd. contains what part of an acre?

87. Express as fractions each of the following in two other ways: $\frac{6}{8}$, $\frac{8}{12}$, $\frac{5}{15}$.

88. What is the per cent of reduction on bedspreads marked down from \$ 2 to \$ 1.50 ?

89. A dealer bought 40 head of sheep at \$ 4.50 a head and sold them at an advance of 20 %; what did he receive for them ?

90. A dealer bought a horse for \$ 200 and sold him for \$ 250 ; what was the gain per cent ?

91. When \$ 4.50 is paid for the use of \$ 100, what rate per cent is paid ?

92. What part of the day has passed by 7.30 A.M. ?

93. What is the net cost of a bill of goods amounting to \$ 120, on which discounts of $12\frac{1}{2}$ % and 10 % are allowed ?

94. The value of 8 bu. of wheat and 6 bu. of corn is \$ 12. If the value of each bushel of wheat is 90 ¢, what is the value of each bushel of corn ?

95. When \$ 7 is paid for the use of \$ 200, what rate per cent is paid ?

96. Gunpowder is 75 % saltpeter, 10 % sulphur, and 15 % charcoal; how many pounds of each of these are there in a keg (100 lb.) of powder ?

97. The population of a certain town was 450. During the next 10 yr. it increased 4 %; what was it then ?

98. How many perches of masonry are there in a wall 99 ft. long, $1\frac{1}{2}$ ft. thick, and 10 ft. high ?

99. A man has a lot 80 ft. × 60 ft. on which he intends to build a house 40 ft. × 32 ft. ; how many square feet of the lot will he have left for the yard ?

100. What part of an acre does a square contain if it can be inclosed by 32 rd. of fencing?

101. If envelopes are bought at the rate of 20¢ a hundred and sold at the rate of 2 for 1¢, what is the profit on 1000 envelopes?

102. Find the cost of 3374 lb. of shelled corn at 80¢ per bushel (56 lb.).

103. How many square feet of zinc are required to line the sides and bottom of a box 4 ft. long, 4 ft. wide, and 3 ft. deep?

104. Find the interest on $250 from March 1 to May 30 at $4\frac{1}{2}\%$.

105. Find the entire cost of 500 bu. of oats at 55¢ per bushel, the rate of commission being 2% and there being other charges amounting to $4.50.

106. A book agent received a salary of $60 a month and 25% of the sales; how much did he earn in a month in which his sales amounted to $128?

107. There are 2150.42 cu. in. in a bushel and 231 cu. in. in a gallon. Estimate to the nearest hundredth the number of gallons in a bushel.

108. What time elapsed between two events, one of which occurred July 4, 1776 and the other Jan. 1, 1863?

109. What date is 90 days prior to December 15?

110. Milk yields butter to the amount of 4% of its weight; how many pounds of milk will yield 50 lb. of butter?

111. A farmer is offered 60¢ a bushel for 200 bu. of potatoes. He refuses the offer and later sells them for 70¢ a bushel, at which time they had shrunk 10%. Did he gain or lose by holding them, and how much?

112. A merchant bought cloth at $2 per yard. He marked it to gain 20%, but he sold it at a discount of $33\frac{1}{3}$% from the marked price. Find his gain or loss.

113. What was the per cent of reduction on a mattress marked at $10 and sold for $7.98?

114. A farmer who sows 500 lb. of fertilizer to the acre must purchase how many tons for 12 A.?

115. A workman's wages were 22¢ per hour after they had been increased 10%. What were they before the increase?

116. What postage must be paid on sheet music weighing 18 oz.?

117. Find the cost of sending a telegram of 30 words, if the rate is 40¢ for the first ten words and 3¢ for each word over ten.

118. A common brick weighs about $4\frac{1}{2}$ lb.; find correct to the nearest brick, the number that a teamster should load in order that the weight may be a ton.

119. Find the cost of 15 pieces of scantling $2'' \times 3'' \times 18'$ at $20 per thousand feet.

120. Find the discount on carpets marked at $2.50 and on which there were allowed discounts of 25% and 15%.

121. What rate of discount was allowed on an overcoat marked $25 and sold for $18?

122. A dealer sold a horse for $325, which was at a profit of $25; what was the rate per cent of profit?

123. Find the sum of all the prime numbers to 100.

124. Test to see that the following are true:

$$9 \times 9 + 7 = 88$$
$$98 \times 9 + 6 = 888$$
$$987 \times 9 + 5 = 8888$$
$$9876 \times 9 + 4 = 88888$$
$$98765 \times 9 + 3 = 888888$$
$$987654 \times 9 + 2 = 8888888$$
$$9876543 \times 9 + 1 = 88888888$$
$$98765432 \times 9 + 0 = 888888888$$

125. A crib 24 ft. long, 4 ft. wide, and 10 ft. high is filled with corn on the cob; estimating that each bushel of corn on the cob is $\frac{25}{16}$ of a cubic foot and that 2 bu. of corn on the cob will make one bushel of shelled corn, find how many bushels of shelled corn this crib of corn will make.

126. The three ingredients of concrete are cement, sand, and broken stone; for general use these may be mixed in the proportion of one part of cement, 2 parts of sand, and 4 parts of broken stone. How many barrels of sand and how many of broken stone must be used to make concrete in which there are 30 bbl. of cement?

ANSWERS

Book Two

PART I

Exercise 7, page 12

1. 567,574.	**2.** 856,360.	**3.** 1,043,136.	**4.** 4,341,485.	**5.** 2,940,781.
6. 1,352,077.	**7.** 2,210,068.	**8.** 1,089,857.	**9.** 2,084,178.	**10.** 2,008,520.
11. 3,241,763.	**12.** 3,082,272.	**13.** 406,702.	**14.** 320,148.	**15.** 41,619,570.

Exercise 8, page 14

1. 1050. **2.** 16,279. **3.** $783. **4.** 1295; 7555; 1086.

Exercise 10, page 16

1. 1391.	**2.** 97.	**3.** 1087.	**4.** 3314.	**5.** 852.
6. 2549.	**7.** 3998.	**8.** 3722.	**9.** 1689.	**10.** 3769.
11. 19,885.	**12.** 14,206.	**13.** 18,379.	**14.** 26,387.	**15.** 18,881.
16. 30,548.	**17.** 38,378.	**18.** 23,348.	**19.** 19,689.	**20.** 38,812.
21. 388,159.	**22.** 279,849.	**23.** 2874.	**24.** 230,971.	**25.** 160,909.
26. 389,685.	**27.** 559,956.	**28.** 192,589.	**29.** 188,791.	**30.** 567,907.
31. 76,239.	**32.** 39,908.			

Exercise 11, page 18

1. $358. **2.** $4581. **3.** 2092. **4.** $57. **5.** $369. **6.** 449; 300; 210.

Exercise 15, page 22

1. 93,612.	**2.** 123,410.	**3.** 229,704.	**4.** 276,792.
5. 195,020.	**6.** 275,307.	**7.** 380,700.	**8.** 422,518.
9. 344,280.	**10.** $10,947.42.	**11.** $14,066.25.	**12.** $13,770.
13. 382,761.	**14.** 472,236.	**15.** 292,815.	**16.** 420,992.
17. 397,020.	**18.** 462,480.	**19.** 602,905.	**20.** 667,320.
21. 617,234.	**22.** 2,565,052.	**23.** 4,410,880.	**24.** 5,334,252.
25. 10,325,788.	**26.** 17,590,960.	**27.** 31,331,030.	**28.** 25,299,051.
29. 30,440,904.	**30.** 34,207,824.	**31.** 48,875,080.	**32.** 50,965,470.
33. 50,490,570.	**34.** 59,173,125.	**35.** 61,149,960.	**36.** 77,986,100.

Exercise 16, page 23

1. $43,750. 2. $225,000. 3. 17,500. 4. $1375.
5. 2,232,000 mi. 6. $78,000. 7. 6540 ft. 8. 1104 gal.

Exercise 19, page 28

1. 68. 2. 97. 3. 89. 4. 60; remainder 38.
5. 15. 6. 87. 7. 216. 8. 693.
9. 385. 10. 689. 11. 846. 12. 1345.
13. 3742. 14. 8162. 15. 4062. 16. 275; remainder 12.
17. 359; remainder 41. 18. 596; remainder 56. 19. 508; remainder 65.
20. 460; remainder 86. 21. 422; remainder 67. 22. 342. 23. 512.
24. 348. 25. 128. 26. 743. 27. 719. 28. 982.
29. 162; remainder 138. 30. 788; remainder 18.

Exercise 20, page 29

1. $526. 2. 24 bu. 3. $60. 4. 85. 5. 176; 40. 6. 160.
7. 500. 8. 803 lb. 9. 72 yr. 10. 8 yr. 11. 3945 lb. 12. 132.
13. 1760. 14. 60.

Exercise 21, page 30

2. 32,025,000. 3. CXVI; XCIV. 4. MDCL; MCDL.
5. 798; $534.68. 6. $1320. 7. $8220. 8. 1826. 9. $10.04.
10. $331. 11. 21,780 12. $975. 13. 2160. 14. 9346 15. 392.
16. 50. 17. 75¢. 18. $25.80. 19. 76 yr.
20. The latter by $9. 21. $16.50. 22. 987,960. 23. 10.
24. 10. 25. 12. 26. 40. 27. 62,500. 28. $60.75.
29. 1950 lb. 30. $114.96. 31. $14.64. 32. 1440.

Exercise 22, page 35

1. 5. 2. 15. 3. 18. 4. 6. 5. 35. 6. 20.
7. 31. 8. 1. 9. 12. 10. 120. 11. 26. 12. 122.
13. 401. 14. 1312. 15. 1007.

Exercise 23, page 37

12. 1, 2, 3, 5, 7, 11, 13, 17, 19.
13. 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26, 27, 28.
15. 2, 5. 16. 2, 2, 3. 17. 3, 5. 18. 2, 2, 5. 19. 5, 5. 20. 2, 3, 5.
21. 2, 2, 2, 2. 22. 2, 2, 3, 3. 23. 2, 2, 2, 2, 3.
24. 2, 5, 5. 25. 2, 3, 3, 3. 26. 2, 2, 3, 5. 27. 3, 3, 5.
28. 2, 2, 2, 5. 29. 2, 2, 2, 3. 30. 2, 2, 2, 2, 2.

Exercise 26, page 40

1. 8.	2. 2.	3. 4.	4. 9.	5. 10.	6. 4.
7. 3.	8. 1.	9. 4.	10. 18.	11. 6.	12. 6.
13. 2.	14. 4.	15. 4.	16. 2.	17. 2.	18. 2.
19. 2.	20. 27.	21. 16.	22. 24.	23. 3.	24. 2.
25. 30.	26. 2548 lb.		27. 15.	28. 9.	

Exercise 27, page 42

4. 77,260. 5. 89,508,516. 6. 840 bu. 7. 5. 8. 412.
9. 24. 10. 12. 11. 108,192 lb. 12. 656 bu. 13. 9232.
14. 2×12; 3×8; 4×6; $2 \times 3 \times 4$; $2 \times 2 \times 6$; $2 \times 2 \times 2 \times 3$; one.
15. 2, 3, 4, 6, 12. 16. 368 bu. 17. 144.

Exercise 30, page 47

24. $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{4}$. 25. The greater. 26. $\frac{4}{4}$, $\frac{4}{3}$, $\frac{4}{2}$. 27. The less.

Exercise 35, page 51

2. $\frac{7}{3}$.	3. $\frac{10}{3}$.	4. $\frac{20}{3}$.	5. $\frac{13}{4}$.	6. $\frac{6}{4}$.	7. $\frac{7}{2}$.
8. $\frac{12}{2}$.	9. $\frac{17}{2}$.	10. $\frac{8}{5}$.	11. $\frac{20}{9}$.	12. $\frac{40}{9}$.	13. $\frac{50}{9}$.
14. $\frac{10}{9}$.	15. $\frac{70}{8}$.	16. $\frac{20}{7}$.	17. $\frac{32}{12}$.	18. $\frac{41}{8}$.	19. $\frac{81}{4}$.
20. $\frac{188}{16}$.	21. $\frac{126}{12}$.				

Exercise 38, page 53

2. $22\frac{1}{4}$.	3. $12\frac{1}{2}$.	4. 16.	5. $48\frac{3}{4}$.	6. 78.	7. $193\frac{3}{4}$.
8. $34\frac{3}{4}$.	9. $56\frac{1}{12}$.	10. 148.	11. 91.	12. $31\frac{1}{4}$.	13. $93\frac{3}{4}$.
14. $151\frac{1}{3}$.	15. 85.	16. 218.	17. 144.	18. $84\frac{1}{3}$.	19. $46\frac{1}{7}$.
20. $195\frac{1}{3}$.	21. $87\frac{1}{3}$.				

Exercise 40, page 54

2. $\frac{3}{4}$.	3. $\frac{7}{12}$.	4. $\frac{1}{4}$.	5. $\frac{5}{7}$.	6. $\frac{1}{3}$.	7. $\frac{5}{6}$.	8. $\frac{12}{18}$.
9. $\frac{24}{25}$.	10. $\frac{1}{2}$.	11. $\frac{7}{10}$.	12. $\frac{7}{24}$.	13. $\frac{9}{20}$.	14. $\frac{3}{5}$.	15. $\frac{11}{12}$.
16. $\frac{15}{16}$.	17. $\frac{5}{8}$.	18. $\frac{7}{8}$.	19. $\frac{11}{12}$.	20. $\frac{2}{3}$.	21. $\frac{5}{8}$.	

Exercise 41, page 55

2. $\frac{9}{15}$, $\frac{10}{15}$.	3. $\frac{16}{20}$, $\frac{15}{20}$.	4. $\frac{4}{8}$, $\frac{6}{8}$.	5. $\frac{10}{18}$, $\frac{15}{18}$.	
6. $\frac{80}{100}$, $\frac{15}{100}$.	7. $\frac{27}{36}$, $\frac{6}{36}$.	8. $\frac{8}{12}$, $\frac{9}{12}$, $\frac{6}{12}$.	9. $\frac{24}{30}$, $\frac{20}{30}$, $\frac{27}{30}$.	
10. $\frac{10}{20}$, $\frac{15}{20}$, $\frac{12}{20}$.	11. $\frac{16}{24}$, $\frac{6}{24}$, $\frac{9}{24}$.	12. $\frac{20}{60}$, $\frac{45}{60}$, $\frac{48}{60}$.	13. $\frac{60}{72}$, $\frac{8}{72}$, $\frac{27}{72}$.	

Exercise 42, page 56

2. $\frac{8}{12}, \frac{9}{12}$.
3. $\frac{15}{20}, \frac{16}{20}$.
4. $\frac{24}{30}, \frac{25}{30}$.
5. $\frac{10}{15}, \frac{9}{15}$.
6. $\frac{8}{10}, \frac{7}{10}$.
7. $\frac{15}{18}, \frac{16}{18}$.
8. $\frac{6}{12}, \frac{4}{12}, \frac{3}{12}$.
9. $\frac{4}{12}, \frac{6}{12}, \frac{2}{12}$.
10. $\frac{12}{18}, \frac{3}{18}, \frac{4}{18}$.
11. $\frac{12}{20}, \frac{10}{20}, \frac{18}{20}$.
12. $\frac{21}{24}, \frac{10}{24}, \frac{16}{24}$.
13. $\frac{15}{18}, \frac{9}{18}, \frac{4}{18}$.
14. $\frac{4}{10}, \frac{7}{10}, \frac{6}{10}$.
15. $\frac{18}{30}, \frac{9}{30}, \frac{4}{30}$.
16. $\frac{14}{18}, \frac{5}{18}, \frac{13}{18}$.
17. $\frac{5}{30}, \frac{15}{30}, \frac{12}{30}$.
18. $\frac{14}{24}, \frac{9}{24}, \frac{20}{24}$.
19. $\frac{20}{50}, \frac{2}{50}, \frac{8}{50}$.
20. $\frac{8}{36}, \frac{27}{36}, \frac{30}{36}$.
21. $\frac{63}{72}, \frac{30}{72}, \frac{44}{72}$.
22. $\frac{18}{60}, \frac{20}{60}, \frac{33}{60}$.
23. $\frac{24}{36}, \frac{18}{36}, \frac{12}{36}$.
24. $\frac{21}{42}, \frac{12}{42}, \frac{2}{42}$.
25. $\frac{12}{100}, \frac{6}{100}, \frac{15}{100}$.
26. $\frac{30}{120}, \frac{24}{120}, \frac{20}{120}, \frac{15}{120}$.
27. $\frac{6}{12}, \frac{8}{12}, \frac{9}{12}, \frac{10}{12}$.
28. $\frac{10}{20}, \frac{8}{20}, \frac{15}{20}, \frac{14}{20}$.

Exercise 44, page 58

1. $\frac{3}{4}$.
2. $\frac{5}{8}$.
3. $\frac{3}{8}$.
4. $\frac{1}{2}$.
5. $\frac{4}{5}$.
6. $\frac{1}{3}$.
7. $\frac{1}{4}$.
8. $\frac{6}{10}$.
9. $\frac{4}{15}$.
10. $\frac{5}{6}$.
11. $\frac{5}{12}$.
12. $\frac{7}{10}$.
13. $\frac{8}{15}$.
14. $\frac{9}{20}$.
15. $\frac{7}{24}$.
16. $\frac{5}{18}$.
17. $\frac{5}{24}$.
18. $\frac{7}{20}$.
19. $1\frac{1}{6}$.
20. $1\frac{1}{4}$.
21. $\frac{7}{8}$.
22. $\frac{5}{6}$.
23. $1\frac{1}{2}$.
24. $1\frac{3}{8}$.
25. $1\frac{5}{8}$.
26. $1\frac{1}{24}$.
27. $1\frac{7}{12}$.

Exercise 45, page 60

1. $1\frac{7}{24}$.
2. $1\frac{1}{20}$.
3. $1\frac{13}{24}$.
4. $1\frac{17}{24}$.
5. $\frac{29}{48}$.
6. $\frac{23}{48}$.
7. $\frac{15}{32}$.
8. $\frac{13}{24}$.
9. $\frac{23}{64}$.
10. $1\frac{17}{72}$.
11. $1\frac{19}{40}$.
12. $1\frac{14}{15}$.
13. $1\frac{11}{100}$.
14. $1\frac{3}{50}$.
15. $\frac{25}{36}$.
16. $\frac{53}{80}$.
17. $1\frac{19}{40}$.
18. $2\frac{1}{3}$.
19. $2\frac{1}{3}$.
20. $2\frac{1}{48}$.
21. $1\frac{17}{48}$.
22. $\frac{47}{48}$.
23. $1\frac{41}{48}$.
24. $1\frac{14}{15}$.

Exercise 47, page 62

1. $\frac{1}{12}$.
2. $\frac{1}{20}$.
3. $\frac{1}{24}$.
4. $\frac{5}{24}$.
5. $\frac{5}{12}$.
6. $1\frac{1}{10}$.
7. $\frac{3}{16}$.
8. $\frac{5}{18}$.
9. $\frac{11}{72}$.
10. $\frac{13}{30}$.
11. $\frac{3}{8}$.
12. $\frac{1}{18}$.
13. $\frac{7}{54}$.
14. $\frac{31}{150}$.
15. $\frac{13}{60}$.

Exercise 48, page 62

3. $\frac{9}{20}$.
4. $\frac{1}{2}$.
5. $1\frac{1}{8}$ bu.
6. $1\frac{1}{12}$ A.
7. $1\frac{1}{8}$ A.
8. $1\frac{1}{8}$ yd.
9. $\frac{1}{3}$.
10. $2\frac{17}{24}$ mi.
11. $\$1\frac{1}{4}$.
12. $\frac{7}{10}$.
13. $1\frac{3}{8}$ gal.
14. $1\frac{1}{3}$ A.
15. $\$\frac{17}{20}$.
16. $\$\frac{4}{5}$.
17. $\$\frac{3}{4}$.

Exercise 49, page 64

1. $5\frac{11}{16}$.
2. $13\frac{11}{12}$.
3. $19\frac{1}{24}$.
4. $17\frac{23}{32}$.
5. $44\frac{1}{16}$.
6. $89\frac{7}{48}$.
7. $41\frac{1}{3}$.
8. $47\frac{11}{12}$.
9. $117\frac{31}{42}$.
10. $54\frac{7}{12}$.
11. $104\frac{11}{24}$.
12. $116\frac{1}{8}$.
13. $66\frac{2}{3}$.
14. $54\frac{1}{6}$.
15. $67\frac{1}{4}$.
16. $16\frac{2}{3}$.
17. $44\frac{7}{8}$.
18. $52\frac{11}{16}$.
19. $19\frac{3}{5}$.
20. $23\frac{17}{24}$.
21. $11\frac{1}{4}$.
22. $88\frac{1}{2}$.
23. $19\frac{5}{12}$.
24. $62\frac{53}{72}$.

Exercise 50, page 65

1. $70\frac{1}{4}$ A. 2. $138\frac{1}{2}$ rd. 3. $59\frac{1}{2}$ lb. 4. 69 ft. 5. $18\frac{3}{4}$ yd.
6. 13 yd. 7. $\$27\frac{1}{2}$. 8. $24\frac{1}{4}$ lb. 9. $27\frac{1}{2}$ gal. 10. $188\frac{1}{2}$ yd.
11. $7\frac{1}{8}$ A. 12. \$20. 13. $62\frac{1}{2}$. 14. $87\frac{1}{2}$. 15. $\frac{23}{30}$.

Exercise 51, page 66

1. $3\frac{19}{20}$ T. 2. $13\frac{13}{24}$ ft. 3. $53\frac{1}{4}$ mi. 4. $\frac{5}{72}$. 5. $\frac{8}{15}$.
6. 8 lb. 7. $63\frac{1}{2}$ lb. 8. \$12.50. 9. 200. 10. $\frac{9}{10}, \frac{5}{9}, \frac{5}{6}, \frac{9}{15}, \frac{1}{2}$.
11. $\$4\frac{1}{4}$. 12. $58\frac{1}{3}$. 13. $60\frac{3}{4}$ ft. 14. $54\frac{1}{4}$. 15. $\$3\frac{3}{4}$.
16. $5\frac{1}{2}$ in. 17. 113 ft. 18. 25. 19. $88\frac{3}{8}$. 20. $\$187\frac{1}{2}$.
21. $\$3\frac{8}{20}$. 22. $45\frac{11}{12}$. 23. $2\frac{3}{8}$ A. 24. $\$1\frac{1}{2}$. 25. \$126.
26. $\frac{1}{2}$. 27. $\frac{9}{10}$. 28. $\$22\frac{1}{2}$. 29. $\$87\frac{1}{2}$. 30. 139.

Exercise 53, page 70

1. $1\frac{1}{2}$ in. 2. $\$\frac{1}{2}$. 3. 10¢. 4. \$1. 5. 1 qt.
6. $\frac{1}{2}$ lb. 7. $1\frac{1}{2}$ in. 8. $\frac{1}{4}$. 9. 7 A. 10. $2\frac{5}{8}$ qt.

Exercise 55, page 72

1. $4\frac{1}{2}$ yd. 2. $36\frac{3}{4}$ mi. 3. $2\frac{1}{2}$ bu. 4. $9\frac{1}{6}$ min. 5. $7\frac{1}{2}$ ft.
6. $37\frac{1}{2}$ yd. 7. \$5. 8. 39¢. 9. 50¢. 10. \$18.
11. 33¢. 12. 20¢. 13. 40¢. 14. 26¢. 15. $\$4\frac{1}{2}$.
16. $\$12\frac{1}{2}$.

Exercise 57, page 75

1. $2\frac{3}{4}$. 2. $\frac{4}{5}$. 3. $\frac{5}{16}$. 4. $\frac{1}{2}$. 5. $\frac{4}{15}$. 6. $\frac{48}{77}$.
7. $1\frac{1}{5}$. 8. $\frac{15}{28}$. 9. $\frac{2}{3}$. 10. $1\frac{3}{5}$. 11. $3\frac{6}{7}$. 12. $\frac{2}{3}$.
13. $1\frac{1}{20}$. 14. $2\frac{35}{243}$. 15. $\frac{8}{35}$. 16. $1\frac{1}{9}$. 17. $\frac{1}{6}$. 18. $\frac{35}{108}$.
19. $1\frac{1}{3}$. 20. 1. 21. $1\frac{1}{8}$. 22. $\frac{72}{145}$. 23. $\frac{4}{7}$. 24. $\frac{4}{5}$.
25. $\frac{1}{8}$. 26. $\frac{8}{9}$. 27. $1\frac{1}{2}$. 28. $\frac{2}{3}$. 29. $\frac{1}{2}$. 30. $2\frac{1}{2}$.
31. $\frac{6}{55}$. 32. 1. 33. $1\frac{1}{3}$.

Exercise 58, page 76

1. 1. 2. $1\frac{1}{8}$. 3. $3\frac{4}{7}$. 4. $\frac{3}{8}$.
5. $1\frac{1}{12}$. 6. $2\frac{17}{24}$. 7. $1\frac{17}{27}$. 8. $3\frac{3}{4}$.
9. 2. 10. $16\frac{1}{2}$. 11. $18\frac{1}{2}$. 12. $11\frac{3}{4}$.
13. $24\frac{3}{7}$. 14. 65. 15. $10\frac{1}{16}$. 16. 2079.
17. $3029\frac{1}{8}$. 18. $4912\frac{1}{2}$. 19. $5240\frac{1}{4}$. 20. $8319\frac{1}{6}$.
21. $11318\frac{2}{5}$. 22. 14742. 23. 2958. 24. $7598\frac{1}{8}$.

25. $2006\frac{3}{8}$. 26. $20317\frac{1}{4}$. 27. $4086\frac{5}{8}$. 28. $4257\frac{5}{8}$.
29. $3118\frac{1}{8}$. 30. $5974\frac{2}{4}\frac{2}{5}$. 31. $17{,}024\frac{1}{12}$. 32. $3683\frac{1}{6}$.
33. $2929\frac{1}{6}$. 34. $23{,}259\frac{8}{10}$. 35. $19{,}860\frac{4}{5}$. 36. $29{,}592\frac{3}{4}$.
37. $15{,}826\frac{1}{8}$. 38. $7957\frac{1}{12}$. 39. $11{,}849\frac{9}{10}$.

Exercise 59, page 77

1. 12¢. 2. $10\frac{1}{2}$. 3. 6 mi. 4. 10¢. 5. 50¢. 6. 25¢.
7. $\frac{1}{4}$ bu. 8. $1\frac{5}{8}$. 9. $\frac{3}{8}$ A. 10. $2. 11. 9. 12. 24¢.
13. $3\frac{1}{5}$. 14. $20. 15. 20¢. 16. 30¢. 17. 45¢. 18. 30¢.
19. $17\frac{1}{2}$ qt.

Exercise 60, page 78

1. $3.15. 2. 198. 3. $207. 4. 875 lb. 5. $31\frac{7}{8}$.
6. $18\frac{3}{4}$. 7. $12\frac{1}{2}$ lb. 8. $5\frac{1}{16}$. 9. $31\frac{1}{4}$ bu. 10. $14\frac{7}{12}$ in.
11. $365. 12. 1375 lb. 13. $585\frac{3}{4}$. 14. $7\frac{7}{8}$.

Exercise 62, page 81

1. $\frac{2}{5}$. 2. $\frac{1}{8}$. 3. $\frac{1}{10}$. 4. $\frac{1}{8}$. 5. $\frac{1}{8}$. 6. $\frac{1}{8}$.
7. $\frac{1}{8}$ A. 8. $\frac{7}{16}$ in. 9. $\frac{5}{16}$ bu. 10. $\frac{1}{16}$. 11. $\frac{7}{8}$ A. 12. $\frac{1}{32}$ lb.

Exercise 67, page 85

1. $\frac{3}{5}$. 2. $1\frac{1}{15}$. 3. $\frac{27}{28}$. 4. $\frac{3}{5}$. 5. $1\frac{1}{4}$. 6. $\frac{15}{16}$. 7. $\frac{17}{24}$.
8. $\frac{8}{15}$. 9. 3. 10. $3\frac{3}{4}$. 11. $9\frac{1}{3}$. 12. 4. 13. 3. 14. $2\frac{2}{3}$.
15. $2\frac{2}{11}$. 16. $\frac{8}{15}$. 17. $1\frac{1}{8}$. 18. $1\frac{19}{21}$. 19. $\frac{1}{3}$. 20. $\frac{20}{21}$. 21. $\frac{1}{3}$.
22. $\frac{1}{4}$. 23. 2. 24. $\frac{1}{3}$. 25. $1\frac{1}{3}$. 26. $2\frac{3}{4}$. 27. 3.

Exercise 68, page 86

1. 7. 2. $1\frac{3}{5}$. 3. 2. 4. 18. 5. $7\frac{1}{2}$. 6. $21\frac{3}{5}$.
7. 14. 8. $6\frac{1}{4}$. 9. $7\frac{1}{3}$. 10. 12.

Exercise 69, page 86

1. 4. 2. 20. 3. 32. 4. 10. 5. $18\frac{1}{4}$. 6. 19.
7. $16\frac{2}{3}$. 8. 20. 9. 4 mi. 10. 25. 11. 2. 12. 96.
13. $13\frac{7}{8}$. 14. 20. 15. 80.

Exercise 70, page 88

1. 6. 2. 3. 3. 12. 4. 8. 5. 12. 6. 18.
7. 10. 8. 60 lb. 9. 25. 10. $36.

Exercise 71, page 89

1. $\frac{1}{4}$. 2. $\frac{1}{2}$. 3. $\frac{3}{4}$. 4. $\frac{5}{4}$. 5. $4. 6. $5. 7. $\frac{1}{2}$.
8. $20. 9. 48¢. 10. $\frac{1}{2}$. 11. 25¢. 12. $\frac{1}{2}$. 13. 12¢. 14. 10¢.
15. 20 mi. 16. 15¢.

Exercise 72, page 90

1. 3 ft. 2. 69½ ft. 3. 562½ lb. 4. $7½. 5. 52½ in.
6. $4. 7. 6¼. 8. 26⅔. 9. 44¼. 10. 10 in.
11. Eight ninths. 12. 63. 13. 24. 14. 7½. 15. $8¼.
16. $14¼. 17. $168¾. 18. $8. 19. 12½. 20. 50¢.
21. $1½. 22. $2½. 23. $0.96. 24. $3¾. 25. $2.04.
26. $1.20. 27. 14¢. 28. 44. 29. $1½. 30. 10 yd.
31. $9⅜. 32. 2⅝. 33. 37½ bu. 34. 9½ ft. 35. 8.
36. 12. 37. 8. 38. 16,500. 39. 15. 40. $2½.
41. $8¾. 42. 78\frac{1}{10}$. 43. 480. 44. $20½. 45. 6; 3 ft.
46. 10; ½ in. 47. 31¼ A. 48. 21½ bu. 49. $\frac{1}{10}$; ¼. 50. 18.
51. 83$\frac{7}{16}$. 52. $\frac{5}{16}$; ⅝. 53. 200. 54. 15 lb. 55. 30¢.
56. 32. 57. $2½. 58. 90¢. 59. 800. 60. $4.

Exercise 73, page 95

2. $7500; $500. 3. 238. 4. $2632.50. 5. $150. 6. $350.
7. 36. 8. 51,576; 135,356; 65,415. 9. 200. 10. 25.
11. 28. 12. 48. 13. 15. 14. $5 gain. 15. 4.
16. 50¢. 17. 6¼ yd. 18. 5 A. 19. 43¾¢. 20. $1.40.
21. 31½¢. 22. $2090. 23. 16. 24. $3⅓. 25. 813¾ lb.
26. 9⅜ in. 27. 70 ft. 28. ⅓. 29. 21. 30. $210.
31. $4.74½. 32. $247½. 33. 1⅓. 34. 2250 lb.

Exercise 75, page 100

7. .2. 8. .05. 9. .007. 10. .009. 11. .9. 12. .1. 13. .01.
14. .001. 15. .7. 16. .4. 17. .04. 18. .004.

Exercise 77, page 101

1. .25. 2. .75. 3. .80. 4. .50. 5. .45. 6. .025. 7. .050.
8. .375. 9. .205. 10. .210. 11. .500. 12. .675. 13. .24. 14. 1.5.
15. .12. 16. .025. 17. .016. 18. .030. 19. .15. 20. .50. 21. .22.
22. 1.2. 23. .67. 24. .132. 25. .206. 26. 2.12. 27. 4.04. 28. .607
29. 2.5. 30. .040. 31. .86. 32. .164. 33. .107. 34. 1.45.

Exercise 78, page 103

1. .50. 2. .080. 3. .2. 4. .42. 5. .850. 6. .30. 7. .9.
8. .040. 9. .24. 10. .3. 11. .370. 12. .70. 13. .600. 14. .050.
15. .4. 16. .80. 17. .550. 18. .6.

Exercise 79, page 103

2. $\frac{4}{5}$. 3. $\frac{3}{4}$. 4. $7\frac{3}{5}$. 5. $\frac{3}{5}$. 6. $\frac{1}{25}$. 7. $3\frac{3}{4}$. 8. $\frac{1}{4}$. 9. $\frac{4}{5}$.
10. $\frac{7}{8}$. 11. $\frac{4}{5}$. 12. $\frac{1}{2}$. 13. $1\frac{1}{2}$. 14. $\frac{9}{40}$. 15. $7\frac{1}{4}$. 16. $8\frac{1}{2}$. 17. $7\frac{9}{20}$.
18. $9\frac{3}{5}$. 19. $10\frac{9}{10}$.

Exercise 80, page 104

1. .5. 2. .8. 3. .06. 4. .08. 5. .25. 6. .14. 7. .36.
8. .3. 9. .625. 10. .045. 11. .875. 12. .014. 13. .85. 14. .44.
15. 2.9. 16. 8.5. 17. 5.8. 18. 7.12. 19. 8.06. 20. 10.2.

Exercise 81, page 105

1. 38.287. 2. 27.274. 3. 16.845. 4. 1.404. 5. 24.495. 6. 4.948.
7. 144.39. 8. 1.239. 9. 6.201. 10. 1.4. 11. 19.881.

Exercise 82, page 106

1. 4.472. 2. 1.659. 3. 4.3. 4. 3.763. 5. 1.3. 6. 5.53.
7. 50.06. 8. 19.065. 9. 2.569. 10. 2.989. 11. 5.979. 12. 8.514.
13. 8.109. 14. 25.088. 15. .663. 16. 2.85. 17. .709. 18. 9.44.

Exercise 83, page 106

1. $350.46. 2. $11.75. 3. $189.33. 5. $33.17. 6. 8.4 ft. 7. 6.05.
8. $5. 9. $113.04. 10. 18 ft.

Exercise 84, page 109

1. .88. 2. 131.84. 3. 51.2. 4. 2.925. 5. 346.551. 6. 15.04.
7. .66. 8. 2.24. 9. 1.684. 10. 19.17. 11. 4.41. 12. .351.
13. 59.878. 14. 25.19. 15. 529. 16. 9.342. 17. 275.2.
18. 103.092. 19. 1131.6. 20. 51.36. 21. 194.06. 22. 234.9. 23. 141.52.
24. 33.28. 25. 2912. 26. 109.9.

Exercise 86, page 111

1. .001. 2. .4. 3. .09. 4. .09. 5. .004. 6. .002.
7. 1.02; 8. .04. 9. .005. 10. .0005. 11. .001. 12. 1.002.
13. .9. 14. .25. 15. .015. 16. .25. 17. .016. 18. .12.
19. .06. 20. .06. 21. .015. 22. .14. 23. .025. 24. .036.

Exercise 88, page 113

1. .13.	2. .2.	3. .02.	4. .005.	5. .002.	6. .7.
7. .06.	8. .05.	9. .005.	10. .09.	11. .92.	12. .031.
13. .14.	14. 1.2.	15. .024.	16. .12.	17. .15.	18. .025.
19. .12.	20. .24.	21. .25.	22. .5.	23. .5.	24. .75.

Exercise 89, page 114

1. $3125.	2. 141.75 lb.	3. 375 bu.	4. 1250 lb.	5. $0.25.
6. 3.5.	7. 58.5 lb.	8. $1.25.	9. $1.25.	10. $2.50.
11. $4.50.	12. $12.50.	13. $12.50.	14. $19.50.	15. $75.
16. $0.96.	17. $0.288.	18. $56.25.	19. $108.	20. $0.98.
21. $7.	22. $91.			

Exercise 91, page 117

1. 96.	2. 12.	3. 84.	4. 75¢.	5. 30¢.	6. 720.
7. $4.96.	8. 60¢.	9. 90 yr.	10. 3.	11. $4.80.	12. $4.
13. $3.	14. 24 lb.	15. $1.60.	16. 30¢.	17. $16.	18. $1.20.
19. $6.	20. $6.25.	21. 12¢.	22. $1.40.	23. $50.	

Exercise 92, page 121

1. $20.74.	2. $1.20.	3. $4.25.	4. $3.50.	5. $8.095.
6. $7.455.	7. $212.59.	8. $9.325.	9. $55.	10. $10.78.
11. $12.40.	12. $6.20.	13. $208.60.		

Exercise 93, page 125

1. 8.	2. $\frac{1}{2}$.	3. 2.	4. 10.	5. 8.
6. 8.	7. 16.	8. $\frac{1}{2}$; $\frac{3}{4}$.	9. 4; 9; 12.	10. 6; 8; 10.
11. $1\frac{1}{2}$; $2\frac{1}{2}$; $3\frac{3}{4}$; $6\frac{1}{4}$.				

Exercise 94, page 126

1. 24.	2. $\frac{1}{2}$.	3. 4; 2.	4. 32; 16.	5. $\frac{1}{2}$.	6. $\frac{1}{2}$; $\frac{3}{4}$.
7. 48.	8. 6.	9. 16.	10. $3.	11. $25.	12. $1.20.
13. 6; 1.	14. 64.				

Exercise 95, page 128

1. 28 lb.	2. 15 lb.	3. 4 lb.	4. 5.	5. $22\frac{1}{2}$ lb.	6. 4¢.
7. 240.	8. $9.	9. 10.	10. 12 lb.	11. 5.	12. 20¢.
13. 42¢.					

Exercise 96, page 129

1. $16.83. 2. $11.64. 3. $32.62. 4. $16.56. 5. $32.50.
6. $77.04. 7. $32.25. 8. $2.835. 9. $34.20. 10. $13.77.
11. $29.89. 12. $42.84. 13. $60.25. 14. $43.50.

Exercise 97, page 131

1. 90; 91. 2. $3.72. 5. 72. 8. 32. 11. $1.80. 12. $360.
13. $17.50.

Exercise 98, page 133

1. 36; 6; 18. 2. 9; $1\frac{1}{2}$; $4\frac{1}{2}$. 3. 16. 4. $\frac{1}{2}$. 5. $\frac{1}{2}$.
6. $1\frac{1}{2}$. 7. 58. 8. 68 ft. 9. 36. 11. 480.
12. 9; 27. 13. $\frac{1}{2}$. 14. $\frac{1}{2}$. 15. 5 ft. 16. 25.

Exercise 99, page 135

8. 3; 2. 9. 120; 180. 10. 90. 11. A right angle.
12. A right angle. 13. A right angle. 14. 45. 15. 45.

Exercise 101, page 138

3. 4. 4. 16. 5. 25. 6. $\frac{1}{4}$; 36. 7. 10.
8. $\frac{3}{10}$. 9. 10. 10. $272\frac{1}{2}$. 11. 4840. 12. 43,560.
13. 160 rd. 14. 600 ft. 15. $6.40. 16. 40. 17. 102,400.
18. 640. 19. 24. 20. 36. 21. 500. 22. 54.

Exercise 102, page 140

1. 10 ft. 2. 56 rd. 3. 140. 4. 1. 5. 360. 6. $13\frac{1}{2}$.
7. 84. 8. $93\frac{3}{4}$. 9. $4\frac{1}{2}$. 10. 1458. 11. $33\frac{1}{4}$. 12. $78\frac{3}{4}$.

Exercise 103, page 144

1. 64. 2. 125. 3. 54. 4. 5184. 5. 100.
6. $21\frac{3}{4}$. 7. 6. 8. 40. 9. 1620. 10. 180.
14. 55,296. 15. 320. 16. 576. 17. 32. 18. 32.
19. 192. 20. 500 lb. 21. 64.375. 22. 750.

Exercise 104, page 147

1. 120 hr. 2. 480 min. 3. 34 qt. 4. 192 oz.
5. 120 in. 6. 88 yd. 7. 268 oz. 8. 32 pt.
9. 384 qt. 10. 21,600 sec. 11. 132 ft. 12. 54 sq. ft.

13. 1152 sq. in.
14. 5184 sq. in.
15. 1280 sq. rd.
16. 24,200 sq. yd.
17. 420′.
18. 10,800″.
19. 8 qt.
20. $8\frac{3}{4}$ gal.
21. $22\frac{3}{7}$ wk.
22. 9 lb.
23. 7 gal.
24. $8\frac{1}{4}$ gal.
25. 8 pk.
26. $9\frac{3}{8}$ pk.
27. 5 yd.
28. $8\frac{1}{3}$ yd.
29. 5 wk.
30. $5\frac{5}{7}$ wk.
31. $7\frac{1}{2}$ gal.
32. $12\frac{1}{2}$ bu.
33. 126 in.
34. 62 pt.
35. 3240 sq. in.
36. 7260 sq. yd.
37. 120 qt.
38. $5\frac{3}{8}$ bu.
39. 75°.
40. 1200 sheets.
41. 468 units.
42. $12\frac{1}{2}$ bu.

Exercise 105, page 149

1. 72.
2. 196.
3. $39.
4. $78\frac{1}{2}$.
5. 30¢.
6. $2.75.
7. $1.88.
8. $\frac{1}{4}$.
9. $2.
10. 32¢.
11. 45¢.
13. 3.
14. 60¢.
15. $15.
16. $15.
17. $49\frac{1}{12}$.
18. $1.50.
19. 85¢.
20. $12\frac{1}{2}$ lb.
22. $16\frac{1}{3}$.
23. 160.
24. 30.
25. $8.90.
26. $11.
27. $400.
28. 25¢.
29. 15.
30. 1332.
31. $\frac{1}{7}$.
32. $6\frac{1}{4}$.
33. 22.
34. 85.
36. 3960.
37. 36.
38. $5.50.
39. 32.
40. 1,500,000.
41. 1000.
42. 20 da. 20 hr.
43. 365; 366.
44. 52; 1.
45. $3.
46. $1.50.
47. $41\frac{1}{2}$ da.
50. 2208 lb.
51. $1.20.
52. $13\frac{1}{3}$¢.
53. 40.
54. $3.10.
55. $29.40.
56. 25.
57. 5.
58. $10.
59. 9; 16; 25.
61. 1 yd.
62. 15 mi.
63. $15.
64. $1.25.
65. 231; the gallon.
66. 2 da.
67. $1.80.
68. .111.
70. $1.20.
71. 12 ft.
72. 80.
73. 1.
74. 24.
76. $2\frac{1}{2}$.
78. 4000; 2.
79. 5.30 P.M.
80. 8.
81. $8.40.
82. 5.
83. 48.
84. 3000.
85. $2.40.
86. $2.40.
87. $2.80.
88. 450 lb.
89. $235.65.
90. 20.
91. $4.80.
92. $352.55.
93. $4.
94. 112.
95. $11\frac{1}{2}$ lb.
96. $9.

PART II

Exercise 2, page 160

1. 91,596.
2. 97,817.
3. 14,392.
4. 152,772.
5. 2,930,893,000.
6. 5,898,089,000; 353,337,000.
7. 10,440,000.
8. 70,912,000.
9. 5,016,000; 1,254,000.
10. 12,872 lb.
11. $2092.
12. $540.

Exercise 3, page 162

1. 42,480.
2. 77,050.
3. 92,115.
4. 37.
5. 1733.
6. $480.
7. 3125.
8. 8; 6900.
9. $2.
10. silage, 2100; hay, 1120; corn, 420; meal, 70.
11. $1110.

Exercise 5, page 168

1. 2, 2, 3, 13.
2. 2, 7, 13.
3. 2, 2, 2, 5, 7.
4. 2, 3, 3, 5, 7.
5. 3, 5, 7, 7.
6. 3, 3, 5, 17.
7. 7, 11, 13.
8. 2, 3, 3, 5, 5, 7.
9. 2.
10. 2, 5, 10.
11. 3, 5, 15.
12. 2, 11, 22.
13. 2, 3, 5, 6, 10, 15, 30.
14. 2, 5, 7, 10, 14, 35, 70.
15. 8.
16. 14.
17. 7.
18. 18.
19. 25.
20. 56.
21. 7.
22. 8.
23. 10.
24. 26.
25. 35.
26. 48.
27. 108.
28. 192.

Exercise 6, page 169

1. 84.
2. 672.
3. 252.
4. 198.
5. 840.
6. 375.
7. 260.
8. 945.
9. 1694.
10. 450.
11. 312.
12. 450.
13. 840.
14. 6050.
15. 5005.
16. 8190.
17. 4860.

Exercise 7, page 170

1. 519 mi.
2. 10,267,417 bales.
3. 15¢.
4. 6.
5. $1.64.
6. 5.
7. 720; 2.
8. 3200 ft.
9. $60.
10. 97.
11. $2960.
12. 2, 3, 5.
14. $54.75.
15. 1,600,000.
16. 1000.
17. 10,000.
18. 24.
19. 30.
20. 4¢.

Exercise 8, page 172

9. $\frac{7}{4}$. 10. $\frac{20}{9}$. 11. $\frac{101}{9}$. 12. $\frac{70}{8}$. 13. $\frac{237}{4}$. 14. $\frac{400}{9}$.
15. $\frac{245}{8}$. 16. $\frac{77}{8}$. 17. $\frac{243}{8}$. 18. $\frac{27}{8}$. 19. $\frac{400}{9}$. 20. $\frac{400}{9}$.
21. $33\frac{1}{3}$. 22. $16\frac{2}{3}$. 23. $12\frac{1}{2}$. 24. $8\frac{1}{3}$. 25. $6\frac{1}{4}$. 26. $66\frac{2}{3}$.
27. $33\frac{1}{3}$. 28. $16\frac{2}{3}$. 29. $18\frac{4}{7}$. 30. $9\frac{2}{7}$. 31. $31\frac{1}{2}$ 32. $37\frac{1}{2}$.
35. $\frac{13}{15}$. 36. $\frac{34}{51}$. 37. $\frac{15}{16}$. 38. $\frac{27}{16}$. 39. $\frac{5}{7}$. 40. $\frac{31}{32}$.
41. $\frac{29}{31}$. 42. $\frac{41}{47}$. 43. $\frac{9}{10}$. 44. $\frac{1}{2}$. 45. $\frac{15}{4}$. 46. $\frac{17}{11}$.
48. $\frac{6}{12}$, $\frac{9}{12}$, $\frac{10}{12}$, $\frac{7}{12}$. 49. $\frac{16}{36}$, $\frac{12}{36}$, $\frac{10}{36}$, $\frac{7}{36}$. 50. $\frac{33}{50}$, $\frac{24}{50}$, $\frac{9}{50}$, $\frac{4}{50}$.
51. $\frac{6}{14}$, $\frac{5}{14}$, $\frac{1}{14}$. 52. $\frac{72}{78}$, $\frac{15}{78}$, $\frac{6}{78}$. 53. $\frac{2}{5}$, $\frac{3}{5}$, $\frac{3}{5}$.
54. $\frac{40}{315}$, $\frac{6}{315}$. 55. $\frac{192}{375}$, $\frac{240}{375}$. 56. $\frac{407}{1155}$, $\frac{150}{1155}$.
58. $1\frac{1}{8}$. 60. $1\frac{4}{15}$. 61. $1\frac{1}{4}$. 62. $1\frac{1}{4}$. 63. $1\frac{17}{30}$. 64. $\frac{11}{16}$.
65. $1\frac{233}{300}$. 66. $4\frac{9}{16}$. 67. $5\frac{73}{144}$. 71. $\frac{1}{60}$. 72. $\frac{1}{60}$. 73. $\frac{47}{75}$.
74. $\frac{53}{72}$. 75. $\frac{7}{60}$. 76. $\frac{19}{180}$. 77. $\frac{1}{210}$. 78. $\frac{1}{144}$. 79. $\frac{11}{16}$.
80. $\frac{3}{5}$. 81. $\frac{8}{110}$. 82. $\frac{11}{15}$. 83. $\frac{17}{24}$. 84. $1\frac{17}{24}$. 85. $\frac{1}{2}$.
86. $\frac{43}{48}$. 87. $\frac{7}{40}$. 88. $\frac{89}{120}$. 89. $102\frac{5}{16}$. 90. $69\frac{7}{30}$. 91. $76\frac{7}{15}$.
92. $73\frac{1}{48}$. 93. $144\frac{7}{15}$. 94. $333\frac{1}{3}$. 125. $1\frac{1}{3}$. 126. $\frac{3}{4}$. 127. $\frac{56}{135}$.
128. $\frac{8}{9}$. 129. $\frac{1}{2}$. 130. $\frac{1}{4}$. 131. $1522\frac{1}{2}$. 132. $3168\frac{3}{4}$.
133. $3797\frac{1}{2}$. 134. $4002\frac{3}{4}$. 135. $7222\frac{3}{8}$. 136. $7042\frac{3}{8}$. 137. $3879\frac{1}{8}$.
138. $10,570\frac{17}{24}$. 160. $\frac{5}{8}$. 161. 100. 162. $19\frac{3}{7}$. 163. $1\frac{47}{128}$.
164. 8. 165. 3. 166. $16\frac{17}{30}$. 167. $20\frac{10}{13}$. 168. $8\frac{1}{3}$.
169. $8\frac{4}{7}$. 170. 15. 171. 10. 172. 28. 173. $\frac{4}{5}$; $\frac{3}{5}$.
174. $\frac{1}{15}$; $\frac{2}{15}$. 175. $\frac{1}{2}$; $\frac{1}{2}$. 176. \$100. 177. \$26$\frac{1}{4}$. 178. $\frac{1}{2}$; $\frac{1}{2}$; $\frac{1}{2}$.
179. 5. 180. $\frac{1}{4}$ lb. 181. 50¢ 182. $\frac{5}{6}$ yd. 183. 8¢.
184. 128. 185. 32 lb. 186. 14¢. 187. 18 mi. 188. 704.
189. 32. 190. 7. 191. $6\frac{2}{3}$. 192. 14. 193. 93¢.
194. 14. 195. 7. 196. 40. 197. $6\frac{1}{4}$ da. 198. $\frac{1}{8}$.
199. $3\frac{3}{4}$ lb. 200. 8 bu. 201. 25¢; $6\frac{1}{4}$¢. 202. 56 lb.; 32 lb.
203. \$$33\frac{1}{3}$. 204. \$$5\frac{3}{5}$. 205. $\frac{5}{12}$. 206. 2240.
207. \$195. 208. \$4500. 209. 20 bu. 210. $2\frac{3}{4}$.
211. 60. 212. Three hundred four six hundred twenty-seconds.
213. 270. 214. \$$7\frac{1}{2}$. 215. 39. 216. 50¢
217. $\frac{5}{8}$. 218. $12\frac{1}{2}$. 219. 10. 220. \$$52\frac{1}{12}$.
221. \$11. 222. $62\frac{1}{2}$¢. 223. $6468\frac{1}{3}$ lb. 224. \$22.20.

Exercise 9, page 183

6. $\frac{3}{5}$. 7. $\frac{5}{12}$. 8. $1\frac{1}{2}$. 9. $11\frac{1}{3}$. 10. $2\frac{1}{12}$. 11. $\frac{1}{3}$. 12. 6.
13. $1\frac{1}{2}$. 14. $\frac{33}{35}$. 15. $33\frac{1}{3}$. 16. $\frac{7}{500}$. 17. 2. 18. $\frac{1}{3}$. 19. $\frac{5}{7}$.
20. $\frac{1}{3}$. 21. 16. 22. 2. 23. $1\frac{33}{35}$. 24. 1. 25. $1\frac{21}{40}$. 26. $1\frac{1}{3}$.
27. $3\frac{7}{16}$. 28. $\frac{3}{160}$. 29. $1\frac{5}{12}$. 30. 1. 31. 100. 32. 100. 33. $\frac{5}{12}$.
34. $\frac{3}{247}$. 35. $\frac{1}{6}$. 36. 3.

Exercise 12, page 186

9. .01; .2; .003. 10. .7; .0006; .00007. 11. .03; .0006; .000004.
12. .6; .005; .06. 13. .004; .000006; .4. 14. .07; .008; .00009.

Exercise 15, page 187

1. .36. 2. .45. 3. .0036. 4. .058. 5. .00056.
6. .000088. 7. .16. 8. .025. 9. .325. 10. 3.50.
11. 7.90. 12. 8.075. 13. .18. 14. .0015. 15. .025.
16. .607. 17. .000019. 18. .00185. 19. .0325. 20. .28.
21. 6.021. 22. .000204. 23. 20.7. 24. .206. 25. 200.006.

Exercise 17, page 189

3. .20. 4. .640. 5. 2550. 6. .2. 7. .24. 8. .5.
9. .200. 10. .040. 11. .005000. 12. .2. 13. .60. 14. .2500.

Exercise 18, page 190

1. $\frac{4}{5}$. 2. $\frac{7}{25}$. 3. $\frac{1}{4}$. 4. $\frac{1}{250}$. 5. $\frac{3}{40}$. 6. $\frac{9}{40}$.
7. $\frac{9}{10}$. 8. $\frac{1}{400}$. 9. $7\frac{1}{2}$. 10. $1\frac{2}{25}$. 11. $12\frac{1}{250}$. 12. $6\frac{11}{40}$.
13. $\frac{5}{6}$. 14. $\frac{5}{8}$. 15. $\frac{1}{3}$. 16. $\frac{4}{5}$. 17. $\frac{1}{7}$. 18. $\frac{1}{3}$.
19. $\frac{7}{8}$. 20. $\frac{3}{16}$. 21. $\frac{1}{7}$. 22. $\frac{5}{6}$. 23. $\frac{2}{7}$. 24. $\frac{3}{7}$.

Exercise 19, page 191

1. .5. 2. .2. 3. .6. 4. .375. 5. .625.
6. .125. 7. .1875. 8. .875. 9. .12. 10. .35.
11. .3125. 12. .04. 13. .225. 14. .06. 15. .005.
16. .0375. 17. .1$\frac{2}{3}$. 18. .22$\frac{2}{3}$. 19. .58$\frac{1}{3}$. 20. .416$\frac{2}{3}$.

Exercise 20, page 192

1. 2.6661. 2. 5.0257. 3. 31.989. 4. 309.1366.
5. 358.3452. 6. 172.6037. 7. 223.8459. 8. 210.6359.
9. .1524. 10. .2469. 11. .0072. 12. .1644.
13. .2342. 14. .9589. 15. 1.5891. 16. .5613.

Exercise 21, page 193

1. $2.65. 2. $3.25. 3. The former by 16¢. 4. 95.3 mi.
5. $1661.50. 6. .6125. 7. .0244. 8. .01.
9. 326.89 sq. mi.; 86.97 sq. mi. 10. $25.

Exercise 22, page 196

1. 1.75.	2. 16.25.	3. .315.	4. 29.4.	5. 1.425.
6. 1.05.	7. 334.4.	8. 11.25.	9. 12.7.	10. .4644.
11. 3.24.	12. 37.44.	13. .0396.	14. 6.4.	15. 420.
16. 1635.	17. .00015.	18. 25.125.	19. .0101376.	20. 6.64524.

Exercise 25, page 199

1. .05.	2. .5.	3. 4.	4. .6.	5. 72.
6. .4.	7. 12.	8. .25.	9. 4.8.	10. 410.
11. 10.	12. 1000.	13. 5.	14. 12.5.	15. 40.
16. 360.	17. 1.28.	18. .015.	19. .0025.	20. 302.5.

Exercise 26, page 200

1. .4288.	2. 3.1725.	3. .0125.	4. 4.1689.	5. .7667.
6. .0667.	7. .0727.	8. 19.7273.	9. $25.0583.	10. $83.3333.

Exercise 27, page 200

1. 568.48 lb.	2. $8.44.	3. $12.545.	4. 486.75 lb.
5. $1686.625.	6. 73.125 lb.	7. 449.28 lb.	8. 1200 bu.
9. 950 lb.	10. 177½ lb.	11. 23.	12. $800.
13. $8.	14. 32.		

Exercise 28, page 201

1. 60¢.	2. 15¢.	3. 16.	4. $9.	5. 30 gal.
6. 44¢.	7. $3.	8. 15¢.	9. $2.25.	10. 750.
11. 4½.	12. $450.	13. $9.	14. $58.75.	15. 12.
16. 2,566,789.	17. 108,284,000.	18. $43.75.	19. $32.20.	20. $134.

Exercise 29, page 204

1. 4¢.	2. 4¢.	3. 10¢.	4. 10¢.	5. 2¢.	6. 2¢.
7. 3¢.	8. 3¢.	9. 2¢.	10. 4¢.	11. 4¢.	12. 3¢.
13. 4¢.	14. 4¢.	15. 5¢.	16. 3¢.	17. 16¢.	18. 13¢.
19. 14¢.	20. 16¢.	21. 13¢.			

Section 28, page 207

1. 8¢; $5.58. 2. 3¢; 3¢; 5¢; 8¢. 3. $29.12. 4. 8¢; $5.83.
5. 15¢; $40.10.

Exercise 30, page 208

1. \$2.05 ; \$6.25. 2. \$2.70 ; \$10.125. 3. \$3.85. 4. \$2.63. 5. \$3.78.

Section 29, page 209

Net profit per acre, \$16.945.

Section 30, page 210

Net profit per acre, \$23.70.

Exercise 31, page 211

1. $1\frac{1}{2}$.	2. 2.	3. 3.	4. $2\frac{1}{2}$.	5. $\frac{1}{3}$.	6. $\frac{1}{3}$.
7. $1\frac{1}{2}$.	8. $\frac{2}{3}$.	9. $\frac{1}{2}$.	10. $2\frac{1}{2}$.	11. 2.	12. 2.
13. 4.	14. $\frac{1}{8}$.	15. 2.	16. 3.	17. 7.	18. $\frac{1}{4}$.
19. $\frac{3}{10}$.	20. 54¢.	21. 28¢.	22. \$1.60.	23. 15¢.	24. \$1.50.

Exercise 32, page 212

1. $\frac{1}{4}$. 2. $\frac{1}{2}$. 3. 1000 ; 500 ; 500. 4. 50 ; 25 ; 25.
5. 25 ; $12\frac{1}{2}$; $12\frac{1}{2}$. 6. .28. 7. .1. 8. .3.
9. .2. 10. 140 ; 100 ; 150 ; 20 ; 20 ; 50 ; 20.
11. 560 ; 400 ; 600 ; 80 ; 80 ; 200 ; 80.
12. 14 ; 10 ; 15 ; 2 ; 2 ; 5 ; 2. 13. 70 lb. ; 84 lb. 14. 310 lb. ; 372 lb.
15. $136\frac{7}{8}$. 16. \$45.625. 17. 890. 18. 6940.
19. 2145 lb. 20. 1250 lb. 21. 1160 lb. 22. 14.
23. 10. 24. 66.9 ; 5.9 ; 5.35.

Exercise 33, page 216

1. 25.2 ; 10.8 ; 5.4. 2. \$63.54. 3. $\frac{1}{4}$.
4. 280 lb. 5. 200 ; 10 ; 20 ; 1. 6. $10\frac{1}{2}$.
7. 2.09 lb. 8. 21.584 lb. 9. 30.
10. 12. 11. \$12.50. 12. 15 T.
13. 6¢. 14. \$4.65. 15. $8\frac{3}{4}$.
16. \$2.19. 17. \$280. 18. \$1.10.
19. 100. 20. \$3.75 ; \$14.375. 21. \$25.12.
22. 80 gal. 23. \$1,250,285,200. 24. 600 bu. ; 18 T.

Exercise 34, page 219

12. 12. 13. 3 A.M. 14. 1 P.M. 15. 6.
16. 6 P.M. 17. 7.15 A.M. 19. 4. 21. 6 A.M. the following day.
25. 600 ft. 29. The former by 806 ft. 45. 125 lb. 46. 5.

Exercise 36, page 223

2. $1\frac{1}{2}$ mi.; $1\frac{1}{2}$ mi.; $3\frac{1}{2}$ mi.; $2\frac{1}{2}$ mi.; 2 mi.
3. 100′; 150′; 50′; 75′; 125′; 125′.
4. 200. 5. $37\frac{1}{2}$; 100. 6. $87\frac{1}{2}$; 175.
7. 210; 630; 9900; 12000; 16560.

Exercise 37, page 225

1. 288. 2. 6. 3. 4. 4. 72.
5. 48. 6. 432 sq. ft. 7. 72. 8. 252 ft.

Exercise 38, page 228

1. 6 ft. 2. 26 ft. 3. 6 ft.; 4 ft.; 4 ft. 4. 24 sq. ft. 5. 72 sq. ft.
6. 36 sq. ft. 7. 224 sq. in. 8. 10 sq. in. 9. $19\frac{1}{4}$ sq. ft. 10. 9 ft.
11. 5 ft. 12. 48 sq. ft. 13. 6 sq. ft. 14. 45 sq. ft. 15. 24 sq. in.
16. 42 sq. in. 17. $11\frac{1}{4}$ sq. ft. 18. 8 ft.; 17 ft.; 17 ft.

Exercise 39, page 230

1. 4. 2. 8. 3. 7. 4. 12. 5. 8; 9.
6. 20. 7. 36. 8. \$57.60. 9. \$57.60. 10. \$61.25.
11. \$12.96. 12. \$6.40. 13. 63. 14. \$6.40. 15. 72.
16. $7\frac{1}{2}$. 17. 27; $22\frac{1}{2}$.

Exercise 40, page 234

1. 96. 2. 96. 3. 180. 4. 336. 5. 252.
6. 128. 7. $93\frac{1}{3}$. 8. 225. 9. 459. 10. 288.
11. 180. 12. 450. 13. 160. 14. 240. 15. 1125.
16. 400. 17. \$3.60. 18. \$7.68. 19. \$20.16. 20. \$29.95.
21. \$15.36. 22. \$11.52. 23. \$8.96. 24. \$4.41. 25. \$30.
26. \$221.18.

Exercise 41, page 236

1. 4. 2. 8. 3. 12. 4. 16. 5. 2; 6 ft.
6. 28. 7. \$5.58. 8. 56.

Exercise 42, page 237

1. 18. 2. 48. 3. \$7.375. 4. \$8.875. 5. 78.
6. $84\frac{3}{5}$. 7. \$24.09. 8. 4.

Exercise 43, page 239

1. 114 oz.
2. 88 cwt.
3. 104 hr.
4. 670 sq. rd.
5. 102 pt.
6. 658 rd.
7. 150 qt.
8. 102 in.
9. 1094′.
10. 44112″.
11. 4 bu. 2 pk. 4 qt.
12. 32 gal. 3 qt.
13. 7° 6′.
14. 62 lb. 8 oz.
15. 1 hr. 1 min. 15 sec.
16. 15 gal. 2 qt. 1 pt.
17. 2 bu. 1 pk. 3 qt.
18. 2 T. 8 cwt. 75 lb.
19. 34 gal. 1 qt. 1 pt.
20. 55 yd. 1 ft. 8 in.
21. 1° 40′.

Exercise 44, page 241

1. 20 ft. 3 in.
2. 6 T. 9 cwt. 40 lb.
3. 26 yr. 6 mo. 8 da.
4. 52° 19′ 22″.
5. 9 yr. 9 mo. 26 da.
6. 84° 39′ 48″.
7. 4 bu. 1 pk.
8. 2 gal. 3 qt.
9. 21 yr. 27 da.
10. 70 yr. 9 mo. 6 da.
11. Apr. 12, 1777.
12. 15 hr. 6 min.
13. 27 cwt. 60 lb.

Exercise 45, page 243

1. 12 ft. 6 in.
2. 13 gal. 3 qt.
3. 16 bu. 2 pk.
4. 9 gal. 2 qt.
5. 24 bu. 2 qt.
6. 181° 1′ 15″.
7. 2 gal. 3 qt.
8. 2 ft. 4 in.
9. 3 bu. 1 pk. 3 qt. $1\frac{1}{2}$ pt.
10. 5 gal. 2 qt. 1 pt.
11. 6.
12. $6\frac{2}{3}$.
13. 3.
14. 10.
15. 90.
16. 16.
17. $1.50.

Exercise 46, page 244

1. $5.
2. 4.
3. 247.5.
4. $41.47.
5. $24.
6. 180.
7. 32.
8. 8.
9. $38.65.
10. 120.
11. $74.80.
12. 18,258.
13. $819\frac{1}{2}$.
14. $115.20.
15. 100.
16. $20.48.

Exercise 47, page 246

1. $\frac{1}{50}$.
2. $\frac{1}{25}$.
3. $\frac{1}{10}$.
4. $\frac{1}{5}$.
5. $\frac{1}{20}$.
6. $\frac{3}{5}$.
7. $\frac{1}{2}$.
8. $\frac{3}{4}$.
9. $\frac{3}{10}$.
10. $\frac{4}{5}$.
11. $\frac{9}{10}$.
12. $\frac{9}{20}$.
13. 50%.
14. 25%.
15. 20%.
16. 75%.
17. 60%.
18. 80%.
19. 30%.
20. 70%.
21. 150%.
22. 250%.
23. $12\frac{1}{2}$%.
24. $33\frac{1}{3}$%.

Exercise 48, page 247

1. 2.	2. 6.	3. 2.	4. 7.	5. 7.	6. 4.
7. 3.	8. 4.	9. 6.	10. 30.	11. 9.	12. 81.
13. 18.	14. 4.	15. $4.	16. $0.05.	17. $8.	18. $20.
19. $2.	20. $3.	21. $9.	22. $4.	23. 2¢.	24. 40 bu.
25. 2.	26. 1.	27. 2.	28. 9.	29. $12.	30. 16.
31. 40.	32. 30.	33. $240.	34. 60.	35. $8.	

Exercise 49, page 249

1. 71.5.	2. 100.8.	3. 259.7.	4. 340.2.	5. 419.92.
6. 284.8.	7. 357.28.	8. 206.7.	9. 465.92.	10. 642.
11. 2.	12. $9.	13. 3¾ A.	14. 1¾ yd.	15. 1760 ft.
16. 800 lb.	17. 19.2 ft.	18. 200 sheep.	19. $600.	20. $2625.
22. $55.	23. $220.	24. 7 lb.	25. 3.3 lb.	26. 329 bu.

Exercise 50, page 250

1. 12.	2. 32.	3. 15.	4. 25.	5. 500.	6. 7.
7. 5.	8. 5.	9. 30.	10. 40.	11. 80.	12. 20.
13. 3.	14. 1.	15. 24.	16. $90.	17. $25.	18. 4 yd.
19. 40 lb.	20. 1¢.	21. 25¢.	22. 2 ft.	23. 12½ lb.	24. 25.
25. $160.	26. 66⅔ A.	27. 100.	28. $160.	29. 32.	

Exercise 51, page 251

1. 500.	2. 192.	3. 360.	4. 200.	5. 181¼.
6. 500.	7. 544.	8. 400.	9. 24000.	10. 448.
11. 96.	12. 76⅔.	13. 137½.	14. 144.	15. 84.
16. 510.	17. 1920.	18. 248.	20. $480.	21. 3750.
22. 240 rd.	23. 400 ; 260.	24. 400.	25. 500 bu.	26. $864.

Exercise 52, page 253

1. 50%.	2. 60%.	3. 10%.	4. 33⅓%.	5. 4%.	6. 5%.
7. 20%.	8. 2½%.	9. 200%.	10. 100%.	11. 80%.	12. 75%.
13. 50%.	14. 50%.	15. 50%.	16. 50%.	17. 40%.	18. 25%.
19. 25%.	20. 12½%.	21. 10%.	22. 25%.	23. 200%.	24. 300%.
25. 500%.	26. 250%.	27. 200%.	28. 400%.	29. 200%.	30. 250%
31. 20%.	32. 80%.	33. 75%.			

Exercise 53, page 254

1. 25%. 2. 40%. 3. 5%. 4. 8%. 5. 12½%. 6. 14%.
7. 12½%. 8. 33⅓%. 9. 33⅓%. 10. 37½%. 11. 125%. 12. 2%.
13. 20%. 14. 3%. 15. 66⅔%. 16. 1%. 18. 25%. 19. 5.4%.
20. 5%. 21. 12½%.

Exercise 55, page 257

1. $247. 2. $21.84. 3. $140. 4. $96. 5. $960.
6. $400. 7. $382.50. 8. $206.25. 9. $367.50. 10. $224.
11. $243.

Exercise 56, page 258

11. $2.50. 12. 36¢. 13. 60¢. 14. $3000. 15. 8¢. 16. 28¢.
17. 4¢. 18. $90. 19. 2¢. 20. 12¢.

Exercise 57, page 260

1. $202.50. 2. $102. 3. $185.60.
4. $378.125. 5. $4218.75. 6. $140; $640.
7. $61; $549. 8. $420; $1050. 9. $1000; $2000.
10. $2.75; $277.75. 11. $28.60; $314.60. 12. $208; $442.
13. $115; $345. 14. $272.80; $223.20. 15. $74; $148.
16. $5; $495. 17. $500; $500.

Exercise 59, page 263

1. 20% 2. 12%. 3. 15%. 4. 20%. 5. 25% gain.
6. 12½% gain. 7. 12% loss. 8. 3⅓% loss. 9. 33⅓% loss. 10. 10% gain.

Exercise 61, page 265

1. $268.80. 2. $338.40. 3. $2137.50. 4. $240.25. 5. $10.72.
6. $252.50. 7. $366.075. 8. $467.50. 9. $396.79. 10. $2039.52.
11. $437.15. 12. $96.80.

Exercise 62, page 267

1. $6. 2. $10. 3. $48. 4. $54. 5. $10. 6. $75. 7. $5.
8. $40. 9. $48. 10. $3.

Exercise 63, page 268

1. $7.50.	2. $9.	3. $23.40.	4. $88.	5. $2.625.
6. $3.67.	7. $15.675.	8. $3.35.	9. $11.77.	10. $8.80.
11. $29.68.				

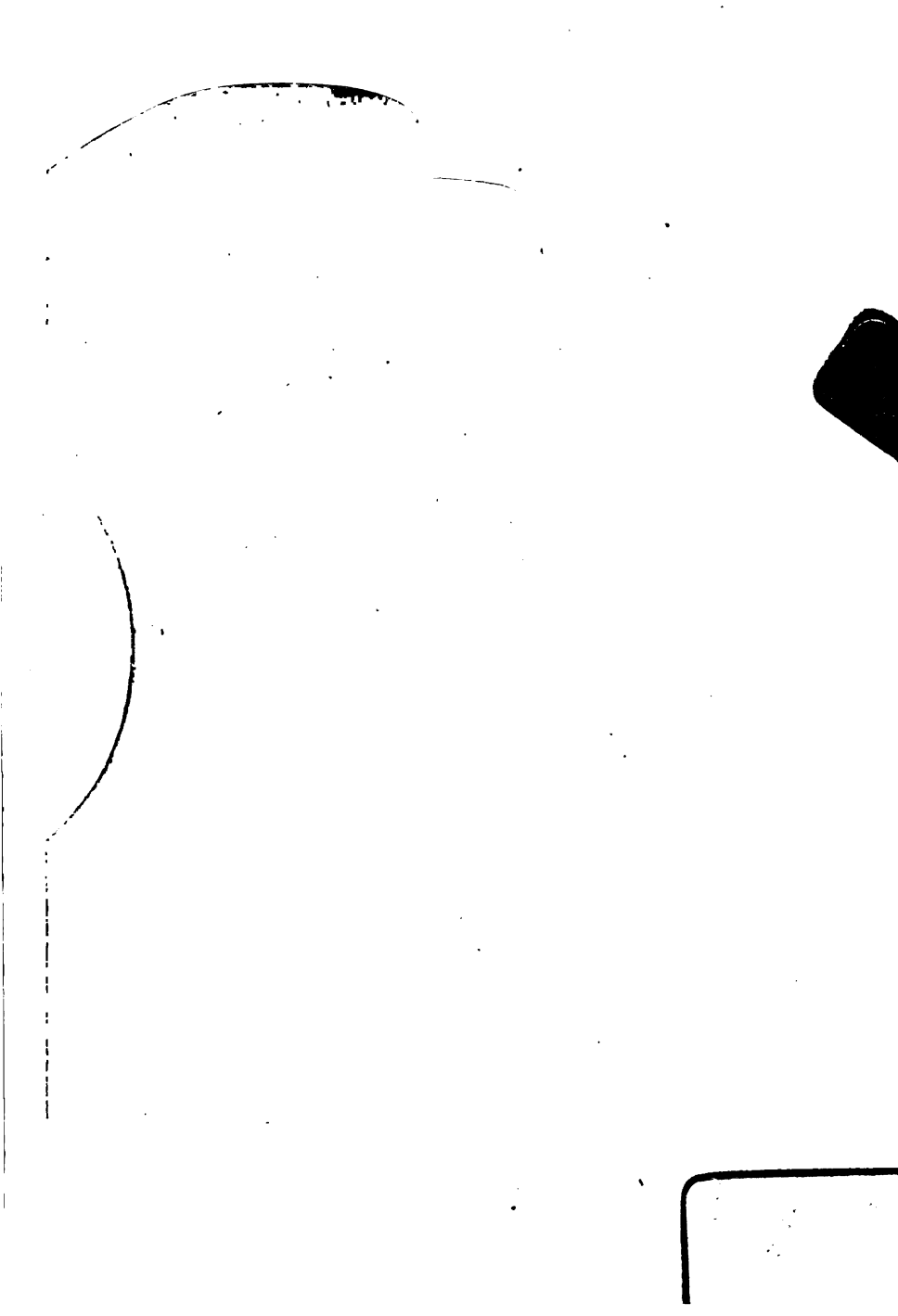
Exercise 64, page 271

1. Aug. 30.	2. Oct. 13.	3. Jan. 30, 1913.	4. May 1.
5. Apr. 28.	6. N. W. Cameron.	9. J. L. Williams.	14. $16.42.
15. $206.33.	16. L. T. Brown.	18. Aug. 1.	

Exercise 65, page 273

1. 16 yd.	2. 8½ lb.	3. $27.45.	4. $10,000.	5. $200.
6. 100%.	7. 12½ %.	8. 280 lb.	9. 25%.	10. $82.68.
11. $6.02.	12. 15,150.	13. 100 lb.	14. $612.	15. $92.50.
16. $1.35.	17. $864.	18. 20%.	19. 25%.	20. $3.24.

General Review, page 275

1. 7,750,000.	2. $539.50.	3. $60.
4. 645.	5. 60.	6. $28.125.
7. 14.4.	8. 17 hr. 30 min.	9. $100.
10. $93.60.	11. 2560.	12. 2¾.
13. $.625.	14. 7035 lb.	15. $52.08⅓.
16. 654.375 lb.	17. 30.25 bu.	18. $0.80775.
19. 14.3 bu.	20. 10; 16.	21. 1 da.
22. $1.22.	23. 10.	24. 2920.
25. 166⅔ lb.	26. $144.	27. 86,400.
28. $2.70.	29. Oct. 13.	30. 6 lb.
31. 4¢.	32. $4.	33. 26⅔¢.
34. 87½ lb.	35. $33.86.	36. 12.
37. 937.5 lb.	38. 200.	39. $6.30.
40. $1.084.	41. 34.	42. $165.36.
43. $22.12.	44. 4½.	45. $16⅞.
46. $80.	47. 2.	48. $24.50.
49. 18.	50. $6.24.	51. $48.
52. $4024.70.	53. 2250 lb.	54. $5.08.
55. $8½.	56. 50⅛.	57. $4.36.
58. $21.	59. 5 ft. 3 in.	60. $2.50.

61. 2200 lb.
62. $5.12.
63. 60.5 bu.
64. 5.
65. 86.
66. $\frac{3}{5}$.
67. 1728.
68. 1521.
69. 24.
70. 32¢.
71. XCIV.
72. 50%.
73. 11%.
74. 5%.
76. 108.
77. 25%.
78. $23.67.
79. 16.
80. 50.
81. 6¢.
82. $91.
83. 12.
84. 76.8.
85. $1122.
86. $\frac{5}{8}$.
87. $\frac{3}{4}$, $\frac{9}{12}$; $\frac{2}{3}$, $\frac{4}{6}$; $\frac{1}{3}$, $\frac{2}{6}$.
88. 25%.
89. $216.
90. 25%.
91. $4\frac{1}{2}$%.
92. $\frac{5}{16}$.
93. $94.50.
94. 80¢.
95. $3\frac{1}{2}$%.
96. 75; 10; 15.
97. 468.
98. 60.
99. 3520.
100. $\frac{2}{5}$.
101. $3.
102. $48.20.
103. 64.
104. $2.81.
105. $285.
106. $92.
107. 9.31.
108. 86 yr. 5 mo. 27 da.
109. Sept. 16.
110. 1250.
111. $6 gain.
112. 40¢ loss.
113. $20\frac{1}{5}$%.
114. 3 T.
115. 20¢.
116. 9¢.
117. $1.
118. 444.
119. $2.70.
120. $90\frac{5}{8}$¢.
121. 28%.
122. $8\frac{1}{3}$%.
123. 1061.
125. 307.2.
126. 60; 120.